

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

N.D.	none detected	BMQL	Below Minimum Quantitation Level
TNTC	Too Numerous To Count	MPN	Most Probable Number
IU	International Units	CP Units	cobalt-chloroplatinate units
umhos/cm	micromhos/cm	NTU	nephelometric turbidity units
C	degrees Celsius	F	degrees Fahrenheit
meq	milliequivalents	lb.	pound(s)
g	gram(s)	kg	kilogram(s)
ug	microgram(s)	mg	milligram(s)
ml	milliliter(s)	l	liter(s)
m3	cubic meter(s)	ul	microliter(s)
<	less than - The number following the sign is the <u>limit of quantitation</u> , the smallest amount of analyte which can be reliably determined using this specific test.		
>	greater than		
J	estimated value – The result is \geq the Method Detection Limit (MDL) and $<$ the Limit of Quantitation (LOQ).		
ppm	parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.		
ppb	parts per billion		
Dry weight basis	Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.		

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns $>25\%$
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is $<CRDL$, but $\geq IDL$
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

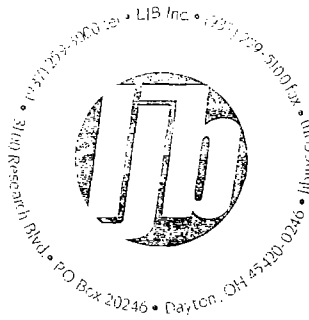
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#77



January 24, 2003

Mr. Billy L. Huston
Environmental Engineer
Behr Dayton Thermal Products LLC
1600 Webster Street
Dayton, Ohio 45404

RE: Risk Evaluation of Disposal Options
VAP-Approved Soil

Dear Mr. Huston:

LJB Inc. (LJB) was contracted by Behr Dayton Thermal Products LLC (Behr) to assist in the evaluation of disposal options for approximately 20,000 to 30,000 cubic yards of Ohio Environmental Protection Agency (OEPA) Voluntary Action Program (VAP) approved soil. The intent of this project was to evaluate potential environmental risks associated with the disposal of the soil.

The disposal options for the soil were defined by Behr and included disposal at either the Waste Management (WMX) Stony Hollow RCRA Subtitle D landfill located at 2460 Gettysburg Avenue in Dayton, OH, or at the SRI Construction and Demolition Debris (C&DD) Landfill located at 1550 Soldiers Home in Dayton, OH. This report also includes a third option, for the recycling of soil at the PetroCell Recycling Facility on Robinson Road at Washington Court House, OH.

As part of the evaluation process, LJB contacted the OEPA-Southwest District, the OEPA Central Region, and the Montgomery County Health Department for information concerning the three disposal facilities. LJB also contacted WMX, PetroCell and SRI concerning their operations. PetroCell provided detailed information concerning their operation, but SRI was unwilling to provide any information concerning their facility. LJB is familiar with the operation of Stony Hollow from previous interactions and contacted the facility to confirm issues associated with their operation.

Numerous factors associated with the disposal facilities were reviewed during the evaluation. These factors were selected based on the ability to infer potential risk associated with the disposal of the VAP soil. The factors reviewed include:

- Differences in regulatory requirements (including liner specifications, closure specifications, financial bonding, groundwater monitoring and leachate management).
- Facility waste profile requirements (i.e. analytical requirements as part of the waste acceptance process).
- Recent regulatory notices of permit violations associated with the operation of the facility.
- Relative waste disposal and transportation costs (i.e. high, medium, and low).
- Time periods open to accept waste.
- Financial backing of the specific facility.

The results of our review of the defined factors are summarized in the attached Table 1.

Based on the data collected during this evaluation, a risk potential exists with placement of the VAP soil at any of the three facilities. For this evaluation, the risk defined for the disposal of the soil primarily centered on the potential that at some future date the selected facility will become a target of a regulatory action due to the off-site release of a regulated material. Released material does not even need to be associated with Behr for Behr to be involved. The use of the disposal facility and/or the placement of the VAP soil may be sufficient for Behr to have a financial obligation associated with the potential future

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regulatory actions. Currently, Behr transports waste material to Stony Hollow. As a result, Behr providing material to another landfill may increase liability by having exposure at multiple facilities.

In the event the selected disposal facility becomes involved in a regulatory action, one of the prime issues affecting Behr will be the ability of the disposal facility to remain financially solvent and completely manage the regulatory action with its own resources. For the three facilities identified in this evaluation, the financial resources of WMX exceed the resources of either of the other two facilities.

In the case of PetroCell, the soil is treated to non-regulatory levels for reuse as fill material at off-site locations. As a consequence of the treatment process, PetroCell issues a certification letter at the completion of the treatment process that indicates the soil is no longer a regulated material. This process should eliminate any future regulatory issues that would be attributed to Behr.

The probability of a regulated material release at each of the facilities has also been considered. In the case of WMX and PetroCell, the design and operational specifications (i.e. liner specifications, closure specifications, financial bonding, groundwater monitoring, leachate management, etc.) are supportive of the low potential risk of a release of regulated material and exceed those used/implemented by SRI.

Based on the number of recent Notices of Permit Violations, SRI may have accepted a material they are not permitted to accept (such as a small can of solvent). The presence of this type of regulated material could then act as a source for future regulatory problems. This concern is supported by the number of recent Notices of Permit Violations associated with the acceptance of unacceptable materials into the SRI landfill. WMX and PetroCell have a lower risk of inadvertently receiving unacceptable materials. Specifically, the PetroCell operations treat soil and remove it from their facility upon completion of the treatment process. Therefore, the PetroCell facility is not a permanent repository of waste materials from numerous sources. In the case of WMX-Stony Hollow, Behr has previously disposed of waste at this facility and the "additional" risk due to the disposal of the VAP soil is minimal.

Overall, the risk potential for the placement of waste material at these three facilities varies from WMX with the lowest potential risk, to SRI with the highest. However, the placement of the VAP soil at PetroCell may also provide a disposal option with potentially low risk. In the case of PetroCell, the disposal can only be fully evaluated by review of their proposal cost and the terms and conditions for the acceptance of the VAP-approved soil.

We hope this evaluation meets your project needs. If you need any additional information, please contact me at 259-5163.

Sincerely

LJB Inc.



Edward Council, PG
Senior Geologist

Enclosure

cc: File

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TABLE 1: EVALUATION MATRIX OF POTENTIAL DISPOSAL FACILITIES

REVIEW FACTORS	WMX-STONY HOLLOW	SRI	PETROCELL
Type Of Operation	Sanitary Landfill/RCRA Subtitle D Facility	Construction & Demolition Debris Landfill	Recycling Facility
General Class Of Waste Accepted	Solid and Special Waste (including petroleum contaminated soil)	Construction & Demolition Debris	Organic contaminated soil that is not classified as a Hazardous Waste
Liner Specifications	Multi-Layer Soil and Geosynthetic Liner	None present – none required	Multi-Layer Soil and Geosynthetic Liner
Closure Specifications	Extensive requirements spanning over 30 years	None after placement of final cover	No waste is present at closure. Therefore, closure specifications are limited.
Financial Bonding for Closure Activities	Very high to account for 30 years of post closure monitoring	Very limited; none past placement of final cover	Very limited because waste is removed from the facility prior to its closure.
Insurance	Unknown	Unknown	Moderate - \$5,000,000
Groundwater Monitoring	Very extensive	None required or conducted	None required, but extensive monitoring is conducted adjacent & downgradient of the facility
Current Groundwater Impacts	None identified	Not determined	None identified
Leachate Management	Extensive	None	Extensive
Profile Requirements For Waste Acceptance To Facility	Yes	None identified for the VAP soil	Yes
Recent Regulatory Notices Of Violations	Limited and only to placement of operational weekly cover	At least 10 in past year for placement of operational weekly cover and landfilling of improper materials	None known
Operational Times	7AM to 5 PM, M-F, 7AM to Noon, S	8AM to 5 PM, M-F	7AM to 5 PM, M-F 7AM to Noon, S
Relative Costs for Disposal	Highest	Lowest	Medium
Financial Backing	Highest	Unknown	Unknown

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SDMS US EPA Region V

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Other:

#19

T E C H M E M O

Date: July 3, 2002

To: Rob Stenson, Earth Tech
Gary Stanczuk, DaimlerChrysler

From: Paul Barnes

Subject: **Assessment of the Potential for Enhancing
Natural Attenuation Processes
Dayton Thermal Products Facility
Dayton, Ohio**

DAIMLERCHRYSLER DOCUMENT
CONTROL NO.

SC006, 11082002, 005

Introduction

This technical memorandum is intended to assess the potential for applying enhanced natural attenuation principles to the treatment of groundwater contaminated by tetrachloroethylene (PCE) and trichloroethylene (TCE) at the Dayton Thermal Products facility. In general, TCE contamination at the site is widespread and varies greatly in concentration while the area of PCE concentration is smaller and always co-located with TCE contamination.

Natural attenuation of TCE contamination by either aerobic cometabolism or reductive dechlorination processes is possible at some sites. Since TCE itself is a poor substrate for microbial growth, aerobic cometabolism is generally possible only in the presence of an aerobically degradable substance that allows the growth of organisms that produce a group of enzymes called monooxygenases (MOs), that can begin the degradation process by cleaving the recalcitrant TCE molecule into smaller, more degradable products. These degradation products are many and generally non-persistent, so naturally occurring aerobic cometabolism is difficult to measure directly but this type of spontaneous aerobic cometabolism has been observed on sites where co-contamination with biodegradable compounds like light petroleum hydrocarbons exists.

Reductive dechlorination, the other potential process, must also be facilitated by the presence of another readily biodegradable substrate but reductive dechlorination occurs only under anaerobic and reducing conditions. This process produces a distinct pathway of sequential dechlorination through cis-1,2-dichloroethylene (cis-DCE), vinyl chloride, and ethene, intermediates that sometimes persist long enough to be measured as evidence of reductive dechlorination. Naturally occurring reductive dechlorination is possible in the presence of a significant input of biodegradable substrate combined with persistent reducing conditions.

Either process can be initiated and/or enhanced in most aquifers, depending upon geochemical and hydraulic conditions.

PCE is less amenable to biological treatment overall and aerobic cometabolism by indigenous organisms is not generally possible. PCE must typically be addressed by reductive dechlorination, at least to remove the first chlorine and produce TCE.

Data Evaluation

To determine if any natural attenuation is occurring or has the potential to be enhanced, evaluations of historical contaminant and water level data, and newly collected transformation product and geochemistry

data were conducted. This evaluation consisted of reconstructing and correlating trends in contamination and water table elevation over time, as well as considering geochemical interactions and nutrient availability.

Geochemistry

With respect to overall geochemistry, the aquifer exhibits relatively low dissolved oxygen (<1.0 mg/L) in the most contaminated (shallow) zone, which lends itself to an anaerobic approach such as reductive dechlorination. Competing electron acceptors for reductive dechlorination in the forms of iron, manganese, nitrate, and sulfate are present but in relatively low concentrations, suggesting that contaminants could be addressed efficiently without using excess substrate. pH and alkalinity are also well within reasonable working ranges and the predominance of ferrous iron over ferric iron suggests that the overall redox is at least mildly reducing. In all, geochemical conditions are amenable to a reductive dechlorination approach. Additionally, the concentrations of other electron acceptors such as ferric iron, manganese, nitrate and sulfate are clearly lower in wells where some dechlorination is indicated, confirming that reducing conditions can be developed in the redox range necessary for the reductive dechlorination process to proceed.

Evidence of Existing Dechlorination Activity

In general, while evidence of partial reductive dechlorination is present at some locations, there is substantial heterogeneity in contaminant dynamics across the site. Conditions appear to range from no apparent evidence of attenuation to very significant production of cis-DCE, an indication of reductive dechlorination. Even in locations where the production of cis-DCE is obvious, however, there is little evidence of further dechlorination to vinyl chloride and ethene and the total contaminant mass is relatively unaffected. Fluctuations up to 6 feet in groundwater elevation further confound the evaluation of attenuation because there appears to be some correlation between groundwater elevation and contaminant concentration at many locations. Additionally, there is no substantial evidence of a potential electron donor for reductive dechlorination, though there is some history of petroleum LNAPL releases in some areas and some low concentrations of total organic carbon (TOC) were measurable, though neither could be specifically correlated to observed dechlorination.

To address the difficulties of interpretation, we have selected some individual wells for detailed and separate evaluation. All were selected from the group that was recently re-sampled and they appear to represent the range of site conditions fairly well.

In general, most of the shallow wells that contain PCE or TCE also exhibit some evidence of current or historical dechlorination activity. Specifically, MW008S, MW018S, MWA002, MWA005, MWA006, PZ-012I and PZ-013I (from among the re-sampled set) showed significant concentrations of the TCE reductive dechlorination product cis-DCE. MWA002, MWA006 and PZ-012I are discussed individually below as examples.

Well ID	Summary of Results & Interpretation
MWA002 Depth: 40'	MWA002 (Figure 1) has historically had high PCE concentrations that may be positively correlated to water level. Moderate TCE concentrations may also have been correlated to water level until February of 2000, but have not rebounded from a concentration minimum (for the period considered) observed at that time. Relatively high cis-DCE concentrations were observed beginning in January 1998 and seem to be correlated to, but lagging PCE/TCE concentration change events. This significant reductive dechlorination may account for the continued decline of TCE concentrations despite increasing water levels and the corresponding

increasing PCE concentration. Since 1 ug/L TCE should be dechlorinated to produce only 0.73 ug/L cis-DCE, the very high DCE concentrations observed in July and October of 1999, exceeding both the PCE and TCE concentrations, may indicate some significant dechlorination of PCE as well. This cannot be verified from the available data as groundwater elevation changes may also explain the decrease in PCE, however the PCE concentration in MWA002 has not fully rebounded to previous concentrations as groundwater elevations have returned to previous levels. MWA002 also provides some indication that the microbial population may be able to facilitate degradation beyond cis-DCE, although no vinyl chloride was observed. Peak cis-DCE concentrations did not persist, but the mechanism for its removal is unclear based upon the available data. Further evidence of biological reduction is given by concentrations of nitrate (.047(J) mg/L), and sulfate (35.3 mg/L) that are much lower than the apparent background concentrations which are probably between 2 and 6 mg/L for nitrate and between 80 and 150 mg/L for sulfate. Stimulation of reductive dechlorination in this area should be feasible, but nitrogen nutrient supplementation for bacteria stimulation may also be necessary.

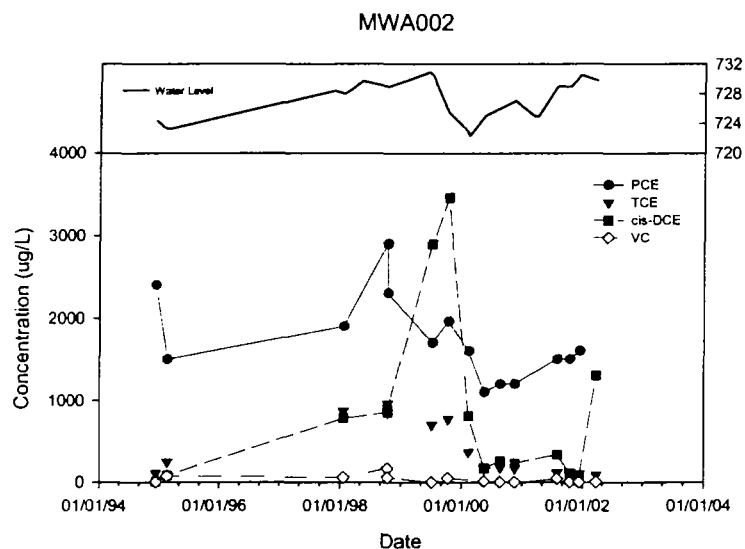


Figure 1: MWA002

MWA006 MWA006 (Figure 2) has historically shown TCE concentrations in the 1,500 to 2,000 ug/L range that may also be correlated with groundwater elevation. A Depth: 40' groundwater elevation low around January of 2000 corresponded to a TCE concentration low, but also with the initiation of some apparent dechlorinating activity that has continued since then. This new level of activity has apparently produced a recent sharp decline in TCE concentration and a corresponding increase in cis-DCE. Nitrate and sulfate concentrations remain relatively high and may be facilitating the process without limitation at this stage, however significant concentrations of TCE and DCE are still present. Enhancement of reductive dechlorination in this area may be possible but would likely require some nitrogen supplementation. Also, it is not clear at this point why vinyl chloride has not been observed but it may be that the high concentrations of TCE favor the kinetics of the first dechlorination step over the subsequent ones.

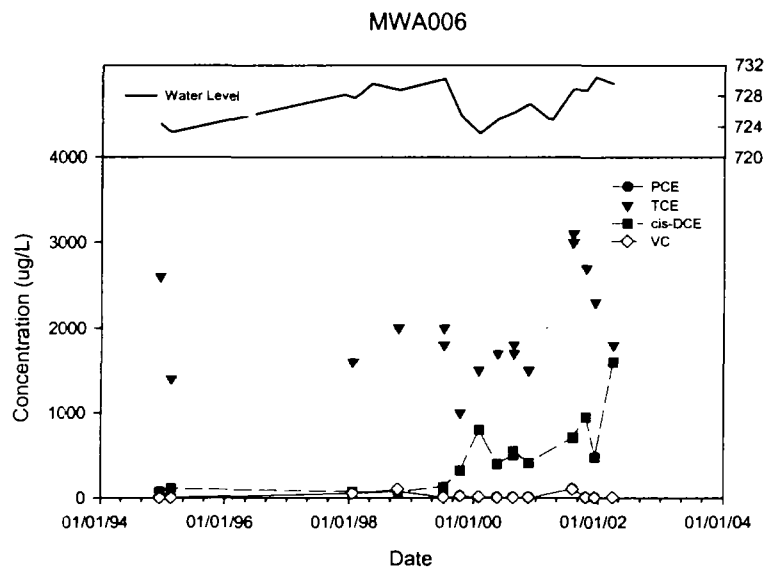


Figure 2: MWA006

PZ012I

Depth: 60'

PZ012I (Figure 3) is different from MWs 002 and 006 in that its contamination profile does not seem to be immediately correlated to groundwater elevation. This is interesting and suggests that the shallow groundwater may be periodically in contact with non-dissolved contaminants in the vadose zone or capillary fringe when water levels change, while deeper groundwater received contaminant input through diffusion from above. PZ012I has shown TCE concentrations as high as 2,000 ug/L, which appeared as a maximum in October 1998. Shortly after this maximum was observed the DCE concentration peaked at around 1,500 ug/L, falling back to and persisting at approximately 500 ug/L since then. After reaching its peak, the TCE concentration declined to levels around 100 ug/L and have persisted in that range. Since the peak TCE concentration does not seem to be associated with a particular hydrologic event it is unclear whether the peak TCE concentration in this area represents a real continuing source or a single release event, however it is clear that additional enhancement will be needed to reach MCLs in this area, as well as to remove the accumulated cis-DCE. Nitrogen has been depleted in this area and may be limiting the capacity for further dechlorinating activity.

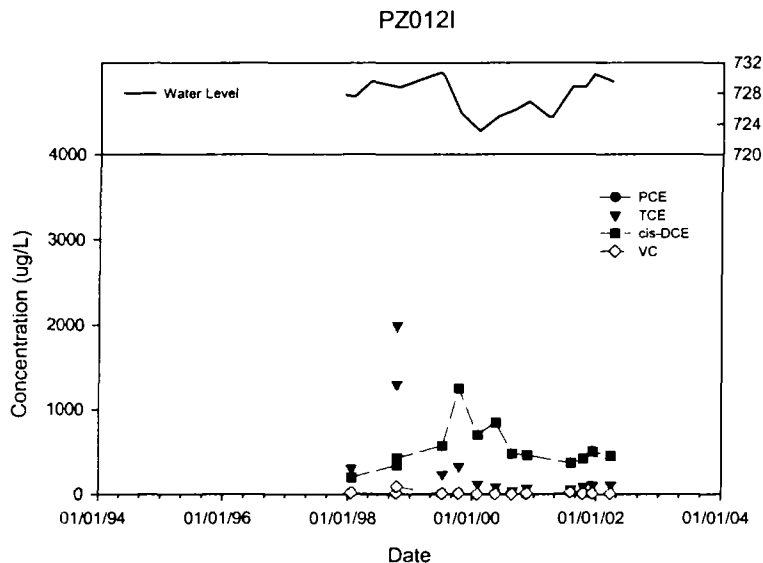


Figure 3: PZ012I

Two of the wells surveyed contained significant contamination but little or no evidence of dechlorination. PZ008I, near an apparently significant source area, and PZ037I, off-site and well separated from the primary release areas.

PZ008I Unlike the wells discussed above, there is very little evidence of dechlorination in
 Depth: 40' PZ008I (Figure 4) despite very high concentrations of both PCE and TCE. Contaminant concentrations are not as well correlated to groundwater elevation in this area, possibly due to a much larger source of continuing contamination in the area. Nitrogen appears to be depleted here as well which may explain the lack of cis-DCE as the partial dechlorination of TCE does produce cis-DCE, but the partial dechlorination of PCE only produces more TCE. Any dechlorination potential expended on PCE in the area of PZ008I would therefore have contributed to the apparent TCE contamination and the concentrations are so high that the resulting increase in TCE concentration would likely be indistinguishable. Enhancement of reductive dechlorination in this area may be possible, but will require a large quantity of substrate and may require supplementation of nitrogen.

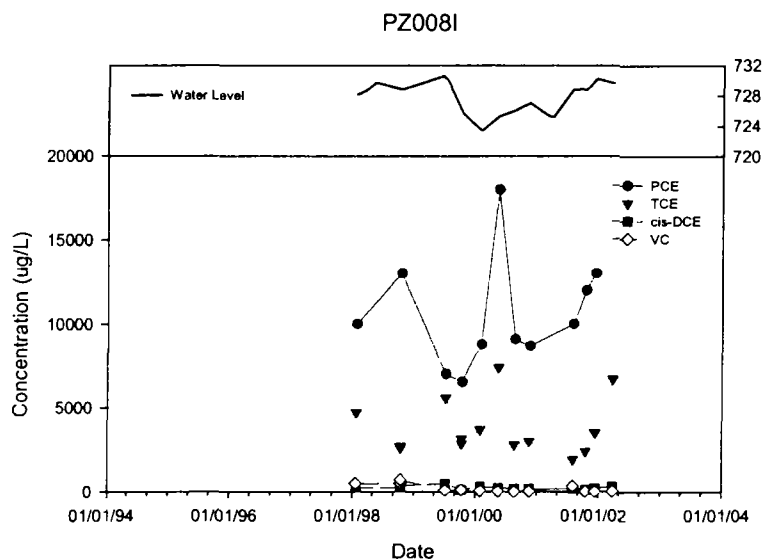


Figure 4: PZ008I

PZ037I
 Depth: 48' No evidence of dechlorination is present in PZ037I despite TCE concentrations in the 4,000 ug/L range. Since little historical data from this location is available, no evaluation of trends can be made but, in the recent re-sample event, no available nitrogen was detected, which may suggest that nitrogen limitation prevents reductive dechlorination in that area.

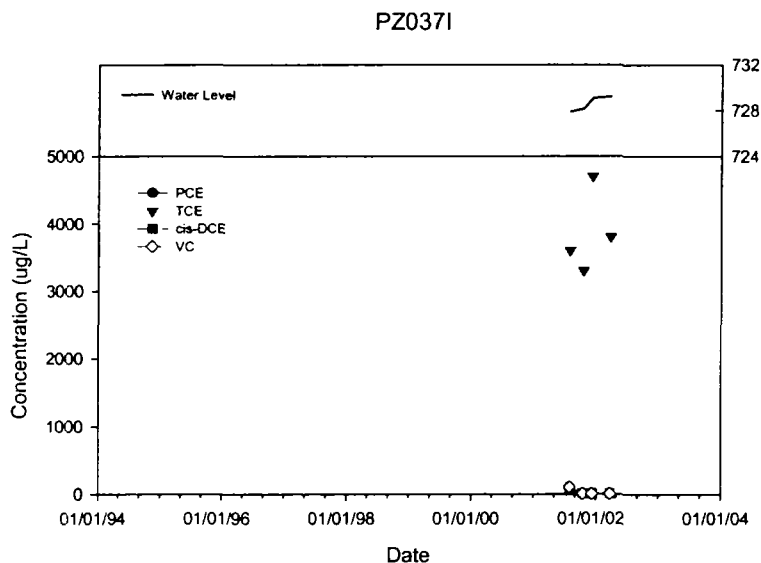


Figure 5: PZ037I

Technology Alternatives

The three primary classes of in-situ technology for remediation of groundwater contaminated by chlorinated solvents are enhanced bioremediation (subclasses discussed earlier), air sparging, and chemical oxidation. Air sparging will not be considered here as the infrastructure requirements and site logistical issues make it an undesirable option if others are available.

Chemical oxidation, consisting of the injection of a strong oxidant such as potassium permanganate, Fenton's reagent (hydrogen peroxide and ferrous iron), or ozone has been shown to be effective on chlorinated solvent contamination at some sites. The quantity of groundwater to be treated suggests that ozone treatment would be cost-prohibitive in this case and site geochemistry is less favorable for permanganate and Fenton's oxidation than might be the case at other sites. Both oxidants are most effective at low pH, as low as 4.0 to 4.5 for Fenton's reagent, which would require a substantial pH adjustment from the 6.0 to 7.8 range measured by Earth Tech. The pH adjustment would be complicated by a high natural buffer capacity. The aquifer's high alkalinity would also consume a substantial amount of any oxidant introduced, as would the naturally occurring organic matter. Other mitigating factors at this site might include the ability to deliver oxidant effectively directly to areas beneath structures and the safe handling of the large quantity of oxidant that would be needed.

In addition to these issues, Earth Tech believes chemical oxidation to be less appealing than reductive dechlorination because PCE and TCE are fundamentally recalcitrant under aerobic and mildly oxidizing conditions (without cometabolic enhancement). This suggests that any failure to completely remove contaminants by chemical oxidation would only leave the residuals in an environment that has already been shown to allow them to persist. The only solution in this case would be repeated attempts at oxidation until success is achieved which is complicated by access limitations. Alternatively, the reductive dechlorination method may also support downgradient cometabolism under aerobic conditions, and it produces degradation products that are known to be aerobically degradable. So, only the first-step dechlorination of the PCE component is required to eliminate the recalcitrant properties of the system. Once this is accomplished, even if reducing conditions were disrupted, there would still remain a possibility of degrading the remaining contaminants by another mechanism such as aerobic cometabolism (TCE) and simple aerobic heterotrophic degradation (vinyl chloride, ethene, ethane) which might be possible without any additional manipulation.

Because some difficulty in affecting in situ treatment can be expected at this type of site and because there is evidence of some naturally occurring capacity for reductive dechlorination, Earth Tech proposes the reductive dechlorination approach as a more cost-effective and logistically manageable alternative. Additionally, the reductive dechlorination technology can easily be combined with the hydraulic control system for delivery of enhancements in-situ, offering an alternative to a technology such as chemical oxidation that requires a more widespread and intrusive application of reagents.

Conclusions

The available data suggests that both groundwater geochemistry and the native microbial population are suitable for at least some reductive dechlorination to occur with additional enhancement. Potential limitations seem to include a lack of available nitrogen and, possibly, a reluctance to move beyond cis-DCE. Supplementing inorganic nitrogen along with the addition of reductive dechlorination substrate can easily address nitrogen limitation and would not be excessively costly. Facilitating dechlorination beyond cis-DCE should also be possible, if more difficult, because cases of genuine limitation in this area are rare. It is more likely that the limited pool of available nitrogen, combined with limited available carbon substrate and the relatively high contaminant concentrations result in a stoichiometric limitation that halts microbial growth before the subsequent dechlorination steps can occur extensively enough to be measured.

Given all of this, Earth Tech would tentatively propose a reductive dechlorination approach for this site, contingent upon some additional pre-design testing to verify the microbial capacity of the system to complete the dechlorination process, as well as to evaluate the extent of nutritional stress imposed by the apparent lack of available nitrogen. Specific recommendations for additional work are described in the next section.

In general, the proposed approach would fit well with any hydraulic containment approach that may be necessary to halt or reverse contaminant migration, especially if such a system includes re-injection. Implementation in a recovery and re-injection configuration would allow substantial optimization of the process for type and quantity of substrate used, supplementation of other nutrients, or even re-distribution of microbial populations from areas of good activity to areas requiring more enhancement.

Recommendations for Additional Testing and Conceptual Approach

In order to address the potential limitations identified above, Earth Tech proposes a combination of microbiological assessment and simple microcosm studies that can be performed concurrently with the implementation of the hydraulic control system. Microbiological assessment would include phospholipid-fatty acid (PLFA) and DNA analysis to determine levels of microbial biomass and community structure with specific screening for known dechlorinating organisms. Microcosm studies would include only very simple stimulation studies to verify that stimulation and/or nitrogen supplementation do, in fact, produce the desired changes in microbial activity under these geochemical conditions. Specific attention would also be paid to verifying, at least qualitatively, further dechlorination or degradation of cis-DCE to vinyl chloride to ethene. These combined efforts would be intended to provide confirmation of gross feasibility and some suggestion of initial design parameters for implementation of a phased remediation program.

Microbiological Assessment

Earth Tech proposes to take samples from six locations representative of the variety of conditions observed. The proposed locations are MWA002, MWA005, MWA006, PZ008I, PZ037I, and MW020S. PLFA analyses will be used to evaluate and compare the microbial community structures in the areas sampled to determine what range of microbiological conditions is occurring without enhancement. The same data will also be used during treatment to evaluate changes affected by any purposeful enhancement. DNA analyses will also be used to identify and enumerate organisms that are known or likely to be capable of reductive dechlorination both before and during treatment and used, in combination with the results from bench scale pilots, to optimize enhancement for those types of organisms.

Microcosm Treatability

Microcosm studies are proposed to satisfy some simple pre-design objectives while hydraulic control is being established at the site. The studies proposed will be simple and focused very specifically on the following issues.

1. Verify and quantify enhancement of the anaerobic biological system in the context of site-specific geochemistry.
2. Evaluate nutritional stress due to the apparent lack of nitrogen, verify that nitrogen supplementation is effective.
3. Verify the system's capacity to complete the dechlorination process.

Studies will be conducted either as static or limited-recirculation microcosms designed to simulate in-situ geochemistry by combining both solid and liquid media from the site. The specific configuration of the physical apparatus will depend upon the properties of the combined media but, in general, will consist of triplicate bioreactors for each condition tested. Each microcosm will be constructed and maintained identically throughout the study (estimated at 60 days), with the exception of the amendment scenario being tested. Measurements of pH and Oxidation Reduction Potential (ORP) would indicate the development of reducing conditions and the time for direct sampling for contaminants and microbiological characterization. At the completion of the study, comparisons of the extents of treatment

Dayton Thermal Products Facility

July 3, 2002

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and/or impacts on the microbial populations under different amendment scenarios would be used to develop baseline design values for in-situ treatment as well as control limits for process monitoring and, possibly a predictive model for treatment.

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PTI Application No. _____
Fee _____

DIVISION OF DRINKING AND GROUND WATER
UNDERGROUND INJECTION CONTROL PROGRAM
CLASS V INJECTION WELL
CLASS V - INJECTION WELL AREA PERMIT FOR REMEDIATION
APPLICATION FOR PERMIT TO DRILL (CONSTRUCT AND INSTALL)

Dayton Thermal Products 3585
Facility Name Primary Sic Code

1600 Webster Street
Facility Address

Dayton OH 45404
City State Zip

Area 937 Number 224-2900
Telephone

☐ Federal ☐ State ☒ Private ☐ Public ☐ Other
Entity Status (check on)

Gary Stanczuk
Person to Contact

800 Chrysler Drive East CIMS 482-00-51
Mailing Address

Auburn Hills MI 48326-2757
City State Zip

Area 248 Number 576-7365
Telephone

Yes ☐ No ☒
Is Facility on Indian Land?

DaimlerChrysler Corporation, 1000 Chrysler Drive, Auburn Hills, MI 48326
If Corporation, Name and Address of Statutory Agency

South Plant: Section 5, North Plant: Section 6, T1 R7 Montgomery County
Location of tract of land where the proposed well is to located, including: Section or Lot Number, City/Village, Township and County

Latitude (North) 39.782570 - 39° 46' 57.3" Longitude (West) 84.182100 - 84° 10' 55.6"
Latitude and longitude of proposed well locations

IW-1 through IW-7
Designation of the wells by number and name

I, being the individual specified in Rule 3745-34-17 of the Ohio Administrative Code (OAC), hereby apply for a Permit to Drill for the Class V Underground Injection Well described herein.

Authorized Signature
(Pursuant to OAC Rule 3745-34-17)

Title

Date

Please be advised that this application must be accompanied by a non-refundable fee of \$2,000.00 pursuant to OAC Rule 3745-34-16 (G)(1).

PTD-UIC

Please Note: Operation of an injection well without an effective Underground Injection Control Permit to Operate is prohibited pursuant to Ohio Revised Code 6111.044.

Completed by _____

Title _____

Date _____

**DIVISION OF DRINKING AND GROUNDWATER UNDERGROUND INJECTION
CONTROL PROGRAM CLASS V INJECTION WELL APPLICATION FOR AREA
PERMIT TO DRILL
(CONSTRUCT AND INSTALL)**

1.

<u>No. of Wells Proposed</u>	<u>Max. Well Depth</u>
<u>Min. Well Depth</u>	<u>Ave. Elevation of Wells (GL)</u>

A total of seven (7) injection wells will be installed under the current groundwater remediation design. It is anticipated that three (3) additional wells may be required. A total of ten (10) injection wells are requested for this permit. The injection wells will be installed to a depth of approximately 80 feet (to the top of the glacial rich till zone) with the well screen interval extending from a depth of approximately 20 feet to 80 feet. Average elevation of the injection wells will be 750 feet +/- 5 feet MSL.

2.

<u>Max. Inj. Rate (GPM)</u>	<u>Avg. Inj. Rate (GPM)</u>	<u>Max. Surf. Injection Pressure (PSIG)</u>
-----------------------------	-----------------------------	---

The maximum injection rate per well is 100 gpm. The average injection rate per well is estimated to be 60 gpm. The maximum surface injection pressure per well is 30 psig.

3.

<u>Name and Depth of Injection Zone</u>	<u>KB to Ground Level</u>
---	---------------------------

The injection zone is the Upper Great Miami Buried Valley Aquifer formation, a quaternary age valley fill sand and gravel outwash unit that extends from ground surface to a depth of approximately 80 feet. The saturated thickness of the Upper Great Miami Buried Valley Aquifer is approximately 60 feet. A glacial till rich zone, encountered at a depth of approximately 80 feet, separates the Upper and Lower sand and gravel units of the Great Miami Buried Valley Aquifer. The glacial till rich zone ranges in thickness from 25 to 5 feet. The depth of the injection zone is approximately 20 to 80 feet below ground surface in the Upper Great Miami Buried Valley Aquifer.

KB to Ground Level: N/A.

4. **Provide a brief description of the nature of your firm's business.**

The Dayton Thermal Products Plant is an automotive component manufacturing plant. Manufactured products include automotive thermal products including air conditioners, radiators, and ventilation systems.

5. **Describe activities conducted by the applicant which require that permits be obtained under the following environmental programs as applicable:**

- a. Resource Conservation & Recovery Act (RCRA);
- b. Underground Injection Control Program (UIC);

- c. **The National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act, and Chapter 6111. of the Ohio Revised Code;* and**
- d. **The Prevention of Significant Deterioration Program (PSD) under the Clean Air Act and Chapter 3704. of the Ohio Revised Code.**

***Please Note:** If liquid or semi-liquid wastes are discharged to a POTW, provide the POTW NPDES permit number.

Activities to be conducted in conjunction with the groundwater remediation project, which require a permit include:

- Construction, installation, and operation of Class V Injection Wells under the Underground Injection Control Program (UIC)
- Discharge from two air strippers of approximately 200 gpm of treated groundwater under the National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act (CWA) and Chapter 6111. of the Ohio Revised Code. NPDES permit # OH 000 9199

A comprehensive description of the groundwater and soil remediation activities to be completed at the facility is presented in Attachment A.

Currently, there are no other groundwater remediation activities being conducted at the site which require a permit.

6. **Provide a listing of all permits or construction approvals received or applied for under any of the following programs:**
- a. **Hazardous Waste Management Program under RCRA and Chapter 3734. of the Ohio Revised code;**
 - b. **UIC Program under the Safe Drinking Water Act (SDWA) and Chapter 6111. of the Ohio Revised Code;**
 - c. **NPDES Program under the Clean Water Act (CWA) and Chapter 611. of the Ohio Revised Code;**
 - d. **The Prevention of Significant Deterioration Program (PSD) under the Clean Air Act and Chapter 3704. of the Ohio Revised Code;**
 - e. **Nonattainment Program under the Clean Air Act and Chapter 3704. of the Ohio Revised Code;**
 - f. **National Emission Standard of Hazardous Pollutants (NESHAPS) preconstruction approval under the Clean Air Act of Chapter 32704. of the Ohio Revised Code.**
 - g. **Ocean Dumping Permits under the Marine Protection Research and Sanctuaries Act;**
 - h. **Dredge and Fill Permits under Section 404 of the CWA and Chapter 3745-32 of the Ohio Administrative Code; and**

i. Other relevant environmental permits, including state permits.

The permits applied for in conjunction with the groundwater remediation project include:

- UIC Permit to Operate a Class V-Injection Well Area Permit for Remediation;
- UIC Permit to Drill Permit to Drill (Construct and Install) a Class V – Injection Well Area Permit for Remediation
- Modification of NPDES Permit #OH 000 9199

Existing / Operating permits currently in-place at the Dayton Thermal Facility include:

a. Hazardous Waste Management Program under RCRA and Chapter 3734. of the Ohio Revised code: OHD074703547

b. UIC Program under the Safe Drinking Water Act (SDWA) and Chapter 6111. of the Ohio Revised Code: None

c. NPDES Program under the Clean Water Act (CWA) and Chapter 611. of the Ohio Revised Code: OH0009199

d. The Prevention of Significant Deterioration Program (PSD) under the Clean Air Act and Chapter 3704. of the Ohio Revised Code: None

e. Nonattainment Program under the Clean Air Act and Chapter 3704. of the Ohio Revised Code: None

f. National Emission Standard of Hazardous Pollutants (NESHAPS) preconstruction approval under the Clean Air Act of Chapter 32704. of the Ohio Revised Code: Facility ID: 0857040734, Source #'s P019,

P020, P021, P022, P025, P030-P044, P045-P049,
P050, P051, P052, P053, P057, P062, P065, P067,
P068, P071, P072, P080, P085, P086, P087, P088,
P089, P090, P093, P095, P096, P098, P099, P100,
P101, & P102. B001, B002, B003, & B004. T005,
T006, T007-T011, T012, & T0013.

g. Ocean Dumping Permits under the Marine Protection Research and Sanctuaries Act: None

h. Dredge and Fill Permits under Section 404 of the CWA and Chapter 3745-32 of the Ohio Administrative Code: None

i. Other relevant environmental permits, including state permits: None

- 7. Provide a topographical map (or other map if a topographical map is unavailable) on a scale not smaller than four hundred feet to the inch, prepared by an Ohio Registered surveyor, extending one mile beyond the property boundaries of the source depicting the facility and each of its intake and discharge; each of its hazardous waste treatment, storage or disposal facilities, including but not limited to neutralization ponds, segregating or mixing tanks, and any solid waste disposal areas on site; each well where fluids from the facility are injected underground, including but not limited to known mines, mineral deposits, and other oil and gas**

reserves; and those wells, springs and other surface water bodies, and drinking water wells listed in public records or otherwise known to the applicant within a quarter mile of the facility property boundary. If the well is or is to be located within the excavations and workings of a mine, the map shall also include the location of such mine, the name of the mine, and the name of the person operating the mine.

The topographical map certified by a State of Ohio registered surveyor is presented in Attachment B.

8. Describe the type of drilling, completion, construction, and injection equipment to be used.

Drilling for the installation of the injection wells will be completed using a Roto-Sonic drill rig. The injection wells will be installed with a well screen interval extending from a depth of approximately 20 feet to 80 feet below ground surface. Wells will consist of 6" PVC piping and well screens sized to match the formation materials. The well screen interval will be backfilled with appropriately sized filter pack sand or natural in-situ formation materials. From ground surface to the well screen interval will be sealed with bentonite. A subterranean vault with a manhole will be constructed for each well to house the injection well manifold equipment.

The injection process and associated equipment includes up to ten injection wells, six groundwater extraction wells, distribution piping, and sodium lactate/groundwater mixing equipment. The groundwater will be pumped at a combined rate of approximately 600 gpm from six extraction wells located along the south and east property boundary. Of the 600 gpm removed by the extraction wells, approximately 400 gpm will be injected back into the aquifer. The remaining 200 gpm of the extracted groundwater will be treated with an air stripper and discharged to the storm sewer system under an NPDES permit. The 400 gpm of injected groundwater will remain untreated and will be augmented with sodium lactate prior to injection to promote reductive dechlorination of chlorinated VOCs. The water will be managed to minimize altering the natural groundwater geochemistry (increased dissolved oxygen, etc.) during the sodium lactate dosing and injection process. The groundwater, augmented with sodium lactate, will be injected at a rate of approximately 60 gpm (100 gpm maximum rate) at each injection well. Each injection well will be fitted with an injection piping system that allows discrete injection at the 25 to 35 foot, 40 to 50 foot, and 60 to 70 foot below grade elevations to provide even application of injected water across the thickness of the aquifer. Injection equipment and process flow diagrams are presented in Attachment C.

9. Provide a plan for the disposal of water and other waste substances resulting, obtained or produced in connection with the injection process.

Cis-1, 2-Dichloroethene	875.3	1051
Tetrachloroethene	1593.5	1913
Trichloroethene	4484.0	5381
Vinyl Chloride	94.3	114

The MSDS for sodium lactate is included in Attachment E.

11. Submit with this application your plans for testing, drilling, construction and installation.

Drilling for the installation of the injection wells will be completed using a Rotasonic drill rig. The injection wells will be installed with a well screen interval extending from the water table to the top of the glacial till rich unit, a depth of approximately 20 feet to 80 feet below ground surface. Wells will consist of 6" PVC piping and well screens sized to match the formation materials. The well screen interval will be backfilled with appropriately sized filter pack sand or natural in-situ formation materials. From Ground surface to the well screen interval will be sealed with bentonite.

12. Provide a map showing the injection well(s) for which a permit is sought and the applicable area of review. The area of review shall be one-quarter mile beyond the injection well(s). Within the area of review, the map must show the number or name, and location of:

- a. **all producing oil and natural gas wells** (None Identified);
- b. **injection wells** (As Proposed);
- c. **abandoned wells** (None Identified);
- d. **dry holes** (None Identified);
- e. **surface bodies of water** (None Identified);
- f. **springs** (None Identified);
- g. **mines (surface and subsurface)** (None Identified);
- h. **quarries** (None Identified);
- i. **water supply wells** (As Shown);
- j. **other pertinent surface features including residences and roads** (As Shown); **and**
- k. **faults, if known or suspected** (None Identified).

The applicable area of review is presented in Attachment F.

13. Provide maps and cross sections indicating the general vertical and lateral limits of all underground sources of drinking water within the area of review, their position relative to the injection formation and the direction of water movement where known, in each underground source of drinking water which may be affected by the proposed injection.

The following text is the description of geologic units for the North Dayton Area (pages 44 and 45) from the Ground-Water Resources of the Dayton Area, Ohio U.S. Geological Survey Water Supply Paper 1808. The maps and cross-sections referenced in the text are presented in Attachment G.

NORTH DAYTON AREA

Geologic sections D-D' and D'-D'' illustrate the character of the valley-fill deposits in the northern part of Dayton. Section D-D' is based on meager data, chiefly that from wells drilled at the plants of the Dayton Castings Co., Premier Rubber Co., and the Chrysler Airtemp Sales Corp., but it is presented to show that in this area, too, the valley fill deposits evidently are separated by till into an upper and a lower sand and gravel aquifer, similar to generally prevailing conditions in the Dayton Area.

Geologic section D'-D'' is drawn northward from the corner of Troy and Valley Streets through the Miami River well field of the City of Dayton, on the west bank of the Miami River approximately 3.5 miles northeast of the center of Dayton. Logs of wells drilled at the Miami River well field clearly show the till-rich zone, which separates the sand and gravel deposits into an upper and lower aquifer. The upper aquifer, lying immediately beneath the soil and the river alluvium, consists of 30 – 40 feet of coarse sand and gravel, into which the Miami River has cut its channel. Beneath the upper aquifer are deposits of till, reported in nearly all the well logs, constituting a well defined till-rich zone between depths of about 40 to 90 feet.

Beneath the till-rich zone at the Miami River well field are 50 – 70 feet of coarse sand and gravel. The lower sand and gravel aquifer is generally underlain by till, which in turn overlies the shale bedrock. Most wells are screened between depths of about 65 and 130 feet, as the test holes records show that in this interval the sand and gravel deposits are coarsest.

Within the area of review, the Great Miami Buried Valley Aquifer is a quaternary age valley fill sand and gravel outwash unit that is separated into an upper and lower aquifer unit by a glacial till rich zone, encountered at a depth of approximately 80 feet. The glacial till rich zone ranges in thickness from 25 to 5 feet. The saturated thickness of the Upper Great Miami Buried Valley Aquifer is approximately 60 feet and the depth of the injection zone is approximately 20 to 80 feet below ground surface. The Lower Great Miami Buried Valley Aquifer is likely 60 to 100 feet thick sequence of outwash sand and

gravel deposits. In the area of review, the groundwater flow direction of the Great Miami Buried Valley Aquifer is predominantly from the northwest to the south and southeast.

Based on the USGS investigations, the Great Miami Buried Valley Aquifer in the area of review is underlain by glacial till, which in turn overlies shale bedrock. The glacial till and the shale bedrock are not used as a source of drinking water in the area of review.

14. Provide the following information as indicated:

- a. maps and cross sections detailing the geologic structure of the local area;**
- b. generalized maps and cross sections illustrating the regional geologic setting; and**
- c. proposed injection procedure; and**
- d. schematic or other appropriate drawings of the surface and subsurface construction details of the well.**

Maps, cross-sections, procedures, and construction details are presented in Attachment H.

Drilling for the installation of the injection wells will be completed using a Roto-Sonic drill rig. The injection wells will be installed with a well screen interval extending from a depth of approximately 20 feet to 80 feet below ground surface. Wells will consist of 6" PVC piping and well screens sized to match the formation materials. The well screen interval will be backfilled with appropriately sized filter pack sand or natural in-situ formation materials. From ground surface to the well screen interval will be sealed with bentonite. A subterranean vault with a manhole will be constructed for each well to house the injection well manifold equipment.

The injection process and associated equipment includes up to ten injection wells, six groundwater extraction wells, distribution piping, and sodium lactate/groundwater mixing equipment. The groundwater will be pumped at a combined rate of approximately 600 gpm from six extraction wells located along the south and east property boundary. Of the 600 gpm removed by the extraction wells, approximately 400 gpm will be injected back into the aquifer. The remaining 200 gpm of the extracted groundwater will be treated with an air stripper and discharged to the storm sewer system under an NPDES permit. The 400 gpm of injected groundwater will remain untreated and will be augmented with sodium lactate prior to injection to promote reductive dechlorination of chlorinated VOCs. The water will be managed to minimize altering the natural groundwater geochemistry (increased dissolved oxygen, etc.) during the sodium lactate dosing and injection process. The groundwater, augmented with sodium lactate, will be injected at a rate of approximately 60 gpm (100 gpm maximum rate) at each injection well. Each injection well will be fitted with an injection piping system that allows discrete injection at the 25 to 35 foot, 40 to 50 foot, and 60 to 70 foot below grade elevations to provide

even application of injected water across the thickness of the aquifer. Injection equipment and process flow diagrams are presented in Attachment H.

- 15. Drilling and construction shall be supervised by a qualified drilling engineer who has authority to act for the company on matters concerning drilling.**

Injection well, drilling and construction, will be conducted by Bowser Morner Drilling, Dayton, Ohio, under the supervision of an Earth Tech Geologist.

- 16. Provisions for collecting the information below for a "completion report" to be submitted not later than 60 days after the completion of the well. The completion report is to include:**

- a. The number of wells drilled;**
- b. The depth of each well drilled; and**
- c. The total volume of grout injected.**

A Completion Report will be submitted no more than 60 days after well completion.

- 17. Submit with this application, a plan for plugging and abandonment per applicable rules of the Ohio Administrative Code.**

Where well abandonment is necessary, the well will either be completely filled with grout or such other material to prevent contaminants from entering ground water in compliance with the Ohio Administrative Code 3745-9-10 – "Abandonment of Test Holes and Wells".

Completed by _____

Title _____

Date _____

Soil and Groundwater Remediation Summary – Dayton Thermal Products, Dayton, Ohio

PREPARED FOR: Gary Stanczuk – DaimlerChrysler Corporation
Mike Curry – DaimlerChrysler Corporation

PREPARED BY: Rob Stenson – Earth Tech

COPIES: Susan Shultz - Earth Tech
Chris Winkeljohn - Earth Tech

DATE: March 4, 2003

Introduction

This technical memorandum has been prepared to outline the soil and groundwater remediation activities and off-site groundwater contaminant plume delineation activities to be conducted at the Dayton Thermal Products facility located in Dayton, Ohio. The facility location is presented on Figure 1. The on-site soil and groundwater remediation strategies include soil vapor extraction, groundwater extraction and re-injection, and in-situ reductive dechlorination. The remediation strategies, developed over the course of the last year, emphasis completing construction and system start-up activities during the summer of 2003. The off-site groundwater contaminant plume delineation strategy is currently being developed and field activities will be initiated in the spring of 2003.

The SVE system has been designed to provide coverage of the primary contaminant source area (defined as the area having a high probability of soil contamination). The SVE well points, with overlapping radii of influences, will remove contaminants from the unsaturated zone and the upper portion of the capillary fringe. Operation of SVE system across the primary contaminant source area will remediate the wide spread contamination. Over time, as portions of the source area are remediated, monitoring and optimization of the extraction and injection well points will focus the soil remediation efforts in the remaining hot spot areas.

The groundwater extraction/re-injection system is designed to contain the down-gradient migration of the contaminated groundwater at the south and east property boundaries and dose the up-gradient edge of the contaminant plume with sodium lactate to enhance the reductive dechlorination process. As this augmented groundwater travels from the re-injection wells to the extraction wells, reductive dechlorination will breakdown the CVOCs and remediate the groundwater beneath the facility. Reductive dechlorination at the capillary fringe will occur during remediation of the groundwater, and this will also promote the breakdown of CVOCs within the unsaturated zone above the capillary fringe.

Available historic information suggests the main body of the contaminant plume extends to the southeast, south, and southwest of the facility in the direction of the predominant groundwater flow direction. Lower concentrations of contaminants to the east and northeast of the facility, are likely due

to intermittent changes in the groundwater flow direction toward the northeast. Plume delineation activities will be conducted to evaluate the off-site geology, hydrogeology, groundwater chemistry, natural attenuation capacity of the aquifer, and to delineate the horizontal and vertical extent of the contaminant plume. *The results of the plume delineation will be used for the design and installation of an effective monitoring well network to monitor groundwater chemistry and the natural attenuation of contaminants.* Following the delineation of the off-site plume, the design and installation of a permanent monitoring well network will be completed.

Soil Remediation

The nature and extent of soil impacts at the facility and the potential for the migration of contaminants in the subsurface have been investigated in sufficient detail to complete the design, construction, and operation of SVE remediation system. The potential soil contaminant sources encompass approximately the southern two-thirds of the facility. The estimated delineation of the primary contaminant source area, presented on Figure 2, is based on potential contaminant sources, the delineation of CVOCs identified in groundwater, and through SVE pilot-scale testing in the field (discussed below). The primary contaminant source area is the focus of the SVE Pre-design Investigation and SVE system design, construction, and operation.

Based on the current understanding of the site and the identified primary contaminant source area, an innovative source delineation and remediation strategy has been developed. The remediation strategy consists of estimating the extent of the primary contaminant source area based on available site information, installing SVE wells at regularly spaced intervals throughout the source area, and monitoring the SVE well performance to determine the effectiveness of the soil remediation.

To increase the confidence that the SVE system will remediate the primary contaminant source area, SVE pilot-scale testing was performed at 17 suspected source areas prior to the SVE system design. The SVE pilot-scale testing identified and confirmed potential sources within the 25 to 50 foot radius of influence at the vapor extraction point and demonstrated that a significant volume of VOCs can be recovered using SVE technology. The results of the pilot-scale testing are presented on Figure 3.

Soil Vapor Extraction System Overview

The strategy for SVE to remediate the primary contaminant source area is to provide coverage of the source area with extraction/injection well points. The SVE design objectives included the following:

- Provide a reliable design to remove soil contaminants to prevent the migration of contaminants to groundwater;
- Provide SVE coverage of the primary contaminant source area;
- Provide an integrated extraction/injection system to focus remediation in hot spot areas;
- Install the SVE extraction points at regularly spaced intervals based on the radius of influence measured during the SVE pilot-scale testing and operation of the existing SVE system in Building 40B;
- Install extraction points screened near the capillary fringe to promote potential hot spot remediation;
- Evaluate contaminants at individual extraction points to map the distribution of contaminants within the primary contaminant source area;
- Design a flexible system to accommodate the initial removal of contaminants over a wide area and long term focused remediation at the capillary fringe and hot spots;

- Design an expandable system to remediate contaminants delineated outside the primary contaminant source area, if deemed necessary; and,
- Monitor system performance to maximize contaminant removal and effectively manage system to remediate contaminant hot spots and demonstrate contaminant removal to obtain a “No Further Action Letter” from Ohio EPA.

The SVE system is designed as two independent units and is presented in Figure 4. The northern unit provides coverage for Buildings 50, and 53, and part of 59 and the truck-way. The southern unit, which includes the integration of the existing SVE system in Building 40B, provides coverage for Buildings 40, 40A, 40B, and the remaining portion of Building 59. Each unit consists of independently-operated banks of up to 10 SVE well points activated by pneumatic valves set by timers. Banks of well points, cycled by timers, are necessary to maintain the required vacuum (or pressure) for establishing the radius of influence at each well point. A total of 117 soil vapor extraction/injection well points are located within the buildings and beneath the concrete in the truck-way.

Each unit includes a skid-mounted building with blowers capable of achieving 1000 scfm at 8-inches of mercury and a knock out chamber capable of removing entrained moisture at the maximum capacity of 1000 SCFM. The vacuum will be induced by the use of two regenerative blowers driven by 30 HP motors. The banks are connected to both the extraction and the injection manifolds to provide flexibility to use a well point bank as an extraction or injection system. The combined ability to both extract and inject air provides the flexibility to focus the flow of air as needed during remediation. The process flow diagram for the SVE system is presented in Figure 5.

Each well point, used as either an extraction or injection point, will be plumbed in banks not exceeding 10 well points per bank. Each bank will be connected to both an extraction and an injection manifold actuated automatically by use of pneumatically operated valves. The SVE wells will be installed at approximately 80-foot centers as shown on Figure 4. Each well will be screened across the twenty foot unsaturated zone below the surface. Well points will consist of 1.5-inch PVC screened from a depth of approximately 5 feet to 20 feet below ground surface. The wells will be installed near to or adjacent to the structural columns. Piping will be trenched from the well to the column and routed up to the well bank main piping. Well points will be installed by Geoprobe direct push methods.

The distribution and concentration of contaminants in the primary contaminant source area will be mapped based on the analytical laboratory results and the radius of influence of the extraction points. Air emissions will be directed through granulated carbon pending the results of the analytical laboratory testing. Mapping the distribution and concentration of contaminants will allow the system to be operated as a conventional SVE system in areas of wide spread contamination and be focused using a combination of extraction and injection points in hot spot areas and potential void zones encountered by equipment in the plant. As areas are remediated to acceptable concentrations to protect groundwater, individual well points can be shut down to increase the vacuum and airflow in other well points in the bank. The net effect of shutting down well points and focusing extraction/injection as the remediation progresses is to increase the strength of the SVE system for the remediation of the highest concentration areas.

SVE System Start-up

During the system start-up, each well point bank will be balanced and operated for several days to up to one week. Individual well points and bank samples will be collected at regular intervals to evaluate maximum contaminant removal per bank to estimate daily emission rates. Individual well point samples will be used to estimate concentrations and determine if any points can be shut down early in the start-up process. The start-up monitoring will also be used to optimize the duration that individual banks will be operated within the cycling regime of the multiple well point bank system. The radius of

influence of select wells will also be confirmed during start-up. During start-up, air emissions will be directed through granulated carbon pending the results of the analytical laboratory testing.

The results for individual well points will be mapped to delineate the extent of contamination within the system coverage area and monitor progress of the remediation effort. At completion of the start-up phase, the system will be optimized for contaminant removal and bank cycle duration and the contaminant distribution will be established. This information will be used to project the estimated time required to complete the SVE remediation.

The emission requirements for full-scale operation will also be evaluated at the completion of the start-up phase. Air emission requirements under OEPA allow for de minis emissions of 10 pounds per day and 1 ton per month for each operating system. The maximum for the multiple remediation systems would be 25 tons per year. The system emission rates established during start-up and the decline in removal rates over time will be considered when recommending the emission control system if one is required. For example, because the system is operated in a cycled bank regime, granulated carbon may be used only on the banks that exceed the de minis 10 pounds per day and not on the remaining banks in the system. Carbon use would then be discontinued when the limits are attained.

SVE System Operation and Maintenance

The operation and maintenance will include monitoring the output by sampling and balancing and tuning of the system based on the sample results, field measurements, and an on-going evaluation of the contaminant distribution and concentrations. Monitoring of the system will allow the operator to continue to maximize the remediation by adjusting individual well banks and begin to integrate air injection into the operational cycles of the system. Injection will be focused to drive air to identified contaminant hot spots. The decrease in concentrations over time will determine the approximate location of persistent hot spots and allow the focus of more intense SVE efforts in these areas. Emission test results will be tracked and documented for regulatory compliance. Operation and maintenance will also include routine maintenance of the mechanical system as recommended by the equipment manufacturers.

Groundwater Remediation

The groundwater remedial approach consists of the design, construction and operation of a groundwater containment system along the south and east property boundaries and an on-site groundwater remediation system using a combination of air stripping and in-situ reductive dechlorination technologies. The groundwater containment system design will prevent off-site migration of chlorinated volatile organic compounds (CVOCs) and establish hydraulic control of groundwater flow at the site. The reductive dechlorination technology consists of the up-gradient re-injection of extraction well groundwater augmented with sodium lactate to promote in-situ reductive dechlorination of CVOCs. The reductive dechlorination will degrade the PCE, TCE, DCE, and VC to ethane and will significantly reduce the timeframe for operating a conventional groundwater containment system. The objectives of the groundwater remedial approach include the following:

- Design a reliable containment system to prevent further off-site migration of contaminants;
- Recover and remediate the contaminant hot spot on the southern site boundary within the radius of influence of the extraction wells;

- Remediate the on-site dissolved phase CVOC plume;
- Design a flexible system to accommodate variations in groundwater flow direction and groundwater contaminant concentrations;
- Perform system monitoring to demonstrate the effectiveness of in-situ reductive dechlorination and, demonstrate contaminant removal to obtain a “No Further Action Letter” from Ohio EPA.
- Minimize interruption to plant activities.

Pre-Design Investigation

Pre-Design Investigation activities were conducted to achieve the following objectives:

- Obtain and evaluate site-specific aquifer hydraulic conductivity data to confirm the physical parameters of the aquifer; and,
- Obtain and evaluate site-specific groundwater geochemistry data to assess the suitability and feasibility of reductive dechlorination.

This data was necessary to support groundwater-modeling efforts and quantify the groundwater extraction well capture zones and groundwater mounding expected with up-gradient groundwater re-injection. The groundwater geochemistry data was evaluated to establish the sodium lactate dosage rate and identify other nutrient requirements necessary to promote reductive dechlorination.

Hydraulic Conductivity

Earth Tech conducted a total of 21 in-situ hydraulic conductivity tests at 11 locations during the Pre-design Investigation to confirm the in-situ hydraulic conductivity. The hydraulic conductivity data evaluation was performed using the AQTESOLV program and a program developed by the Kansas Geological Survey to evaluate the oscillating data collected during some of the field tests. The hydraulic conductivities calculated using the AQTESOLV program ranged from 0.001 to 0.20 cm/sec (4 to 560 ft/day) and 0.03 to 0.09 cm/sec (96 to 264 ft/day) using the oscillating data program. The hydraulic conductivity of the adjacent GEM City well pump test data is approximately 0.23 cm/sec (750 ft/day), which is similar to the values calculated using the AQTESOLV data analysis.

A hydraulic conductivity value of 0.35 cm/sec (1000 ft/day) was selected for design analysis. This value is about 35% greater than the average value calculated from the GEM City pump test and on-site slug tests. A higher design value was chosen to allow for flexibility in system pumping rates. This flexibility is recommended to account for several potential changes in the aquifer system including hydraulic conductivity, transmissivity, and groundwater flow direction. Details of the hydraulic conductivity testing are presented in the Hydraulic Conductivity Technical Memorandum is included in Appendix A.

Groundwater Geochemistry

Pre-design Investigation groundwater geochemistry samples were collected from 30 groundwater monitoring wells located both on-site and within the down-gradient contamination plume to assess overall groundwater geochemistry and evaluate contaminant reductive dechlorination and natural attenuation processes. The groundwater geochemistry sampling and data evaluation indicates the groundwater geochemistry and the native microbial population present at the site are well suited for reductive dechlorination. Currently, PCE and TCE are breaking down to cis-1, 2-dichloroethylene, and with additional augmentation of an electron donor (sodium lactate), the breakdown process will

be enhanced and accelerated. Details of the groundwater geochemistry are presented in the Groundwater Geochemistry Technical Memorandum included in Appendix B.

Groundwater Remediation System Overview

The groundwater remediation system will provide hydraulic capture in the area of highest concentration of contaminants along the southern and eastern border of the property, and inject an electron donor (sodium lactate) into and up-gradient of the PCE/TCE plume to promote reductive dechlorination of the groundwater contaminants. The system design is comprised of three major components including groundwater extraction wells, groundwater treatment system (for water to be discharged to the storm sewer under NPDES permit, and for water to be re-injected), and groundwater re-injection wells. Six groundwater extraction wells will be installed to establish hydraulic control and seven re-injection wells will be installed in the interior of the site. The groundwater extraction and re-injection well locations and the proposed location of the treatment building are presented in Figure 6.

Hydraulic Control System

Based on the design maximum hydraulic conductivity of 0.35 cm/sec (1000 ft/day), groundwater modeling established that a groundwater extraction rate of 600 gpm (100 gpm from six extraction wells) would be required to maintain capture of the groundwater plume at the south and east property boundaries. The modeling also included the up-gradient re-injection of 400 gpm of groundwater to accommodate the dosing of the aquifer with sodium lactate. The remaining 200 gpm of groundwater is treated with an air stripper and discharged to the storm sewer under an NPDES permit to maintain a negative groundwater balance on-site.

The groundwater extraction and re-injection system will create hydraulic containment conditions along the south and east property boundary and groundwater mounding conditions at the injection wells located within the truck way between Buildings 40, 40A, 59 and 39 to the south and Buildings 50, 52 and 53 to the north. The groundwater flow paths shown on Figure 7 present the capture zone of the extraction wells and the reductive dechlorination zone created by the injection of groundwater augmented with sodium lactate. The groundwater flow paths indicate the following benefits of hydraulic control and re-injection:

- Off-site groundwater contamination south and east of the property boundary will be pulled back to the property boundary and recovered;
- On-site groundwater contamination is captured at the south and east property boundaries;
- The reductive dechlorination zone will be established by injection of groundwater, dosed with sodium lactate, into the upgradient portion of the contaminant plume. The reductive dechlorination zone will gradually move downgradient to the capture zone at the south and east property boundary.
- The capture zone, in conjunction with the re-injection wells, will maintain containment of the highly contaminated groundwater located in the central portion of the facility during periods of groundwater flow variation.

The 6-inch diameter extraction wells will be constructed with well screens penetrating the entire saturated thickness of the aquifer (approximately 60 feet). The 600 gpm flow rate will be segregated into two separate lines based on relative contaminant concentrations to allow flexibility in directing the water for air stripping or re-injection. Approximately 200 gpm of the highest contaminant concentration groundwater will be treated with an air stripper to reduce concentrations to meet

applicable NPDES permit requirements and discharged to the storm sewer under an NPDES permit. The remaining 400 gpm of groundwater will remain untreated and be augmented with sodium lactate prior to re-injection. The water segregated for re-injection will be managed to minimize altering the natural geochemistry (increased dissolved oxygen, etc.) during the lactate dosing and re-injection. Re-injection will be through seven 6-inch diameter, fully penetrating PVC well screens. Extraction and re-injection well and piping locations are presented in Figure 8.

Groundwater, augmented with sodium lactate, will be injected at a rate of approximately 60 gpm at each well. Distribution piping will connect the wells and will be routed from the groundwater/lactate mixer by a booster pump. Each injection well will be fitted with an injection system that allows discrete injection at the 25 to 35 foot, 40 to 50, and 60 to 70 foot below grade elevations to provide even application of injected water across the thickness of the aquifer. The necessary permits for the installation and operation of a Class V - Injection Well Area Permit for Remediation will be prepared and submitted for approval to the Ohio EPA, Division of Drinking and Groundwater, Underground Injection Control Section.

Groundwater Treatment System

The treatment system will include four main components consisting of two skid-mounted low-profile air stripper systems each rated at 100 gpm, a lactate/groundwater mixing system with lactate storage tank, and a programmable logic controller (PLC) to control and monitor system performance. The system flow diagram is presented in Figure 9. Groundwater entering the treatment system will be divided using the two distribution manifolds to route approximately 200 gpm of the groundwater volume to the air stripper manifold. The groundwater contaminant concentration will be monitored and maintained by adjusting the groundwater flow using the distribution line manifolds from the extraction wells. A transfer pump connected to the base of the stripper will convey the water from the air stripper to an existing 30" storm sewer pipe running north along Webster Avenue. The discharge of the treated groundwater will be performed following modification to the existing NPDES Permit for the facility.

The remaining 70% of the groundwater flow (400 gpm) will flow in the second manifold and pass directly into the lactate/groundwater mixer for sodium lactate augmentation. A booster pump will convey the augmented groundwater to the re-injection well distribution piping.

The system performance will be monitored by a PLC. The water elevation in the extraction and re-injection wells will be recorded by the PLC from calibrated input signals from pressure transducers located in each extraction and injection well. This water elevation data will be used to:

- Monitor that the capture zone is maintained by comparison to groundwater elevations in monitoring points near the extraction wells;
- Monitor that the re-injection rates do not exceed the capacity of the injection wells;
- Monitor the potential for well fouling over time; and,
- Plan well maintenance to minimize well down time of the system.

In addition to monitoring water levels, the PLC will monitor individual flow rates from each extraction well and the total combined flow to the air stripper system and the lactate augmentation system. The PLC will also monitor the collection sump within the treatment building containment for the presence of water. In the event of an abrupt change in water level in a well, a drop in the system flow, or detection of water in the collection sump, the PLC will shut the system down and notify the operator via the auto-dialer that system maintenance is required. During the system shut down, the

water elevations in the capture zone and the re-injection mound will return to the regional levels and flow direction. As a result of the relatively flat groundwater gradient at the site, the contaminants will gradually migrate (1.3 ft/day) in the direction of the regional groundwater flow. The re-start of the extraction system will recover the groundwater because of the 150 to 250 foot off-property capture zone.

System Start-up and Monitoring

During the system start-up, the extraction wells and re-injection wells will be brought on-line in a pre-determined sequence to provide an opportunity to perform field scale studies of the pumping rates and sodium lactate dose ratio. Field scale testing of the system will be prior to full-scale operation. Field scale testing will provide an opportunity to optimize the pumping rates of individual and combinations of extraction wells and measure the effective capture zone. The re-injection groundwater mounding will also be evaluated during this period.

The pilot-scale testing of the reductive dechlorination process will be evaluated during the system start-up and operation.

To monitor the groundwater anaerobic conditions and the dechlorination progress, groundwater samples will be collected from monitoring wells within the treatment zone. Analysis will include:

- VOCs and bioactivity indicators to evaluate sodium lactate dose requirements;
- Indicator parameters including Total Organic Carbon, Chemical Oxygen Demand, nitrates, manganese, iron, sulfate, and redox potential; and,
- Microcosm studies will be performed to evaluate nutritional needs and monitor the system's capacity to complete the dechlorination process. This information will be used to optimize the reductive dechlorination process.

The specific monitoring wells to be sampled will be determined during the start-up phase of the project. Samples will also be collected from the treatment system to determine the mass of contaminants removed and treatment efficiencies.

Off-Site Plume Delineation

The off-site groundwater plume delineation activities consist of the investigation of the geology and hydrogeology of the aquifer, and the groundwater chemistry and aquifer natural attenuation parameters of the contaminant plume. The plume delineation activities will be focused in the area presented on Figure 10. The objectives of the plume delineation strategy include the following:

- Identify and map the lower confining layer present beneath the site;
- Support the design and implementation of a monitored natural attenuation remedy for the off-site groundwater plume;
- Design and installation of an effective monitoring well network to monitor groundwater chemistry and the natural attenuation of contaminants;
- Design a flexible system to accommodate variations in groundwater flow direction and groundwater contaminant concentrations;

To delineate the horizontal and vertical extent of the plume, field activities include a Geoprobe membrane interface probe and electric conductivity (MIP/EC) investigation, groundwater interval sampling, existing well sampling, water well installation, and groundwater elevation monitoring. The Geoprobe MIP/EC investigation will provide semi-quantitative/qualitative information on volatile organic compound (VOC) contaminant levels in groundwater using the membrane interface probe and subsurface stratigraphy using the electrical conductivity probe. The real-time VOC contaminant level and stratigraphic data acquired with the MIP/EC probe will be evaluated on-site to select groundwater sample intervals. The fieldwork will be performed throughout the potential plume area to expand the understanding of geology and hydrogeology and groundwater chemistry and natural attenuation parameters. The fieldwork will be completed as an iterative process with field data integrated into a working model of the hydrogeologic processes and a 3-dimensional delineation of the contaminant plume. The groundwater plume delineation activities include the following:

Groundwater Level Measurements and Monitoring

To document the groundwater elevation and flow direction during plume delineation activities, ten temporary 1.5-inch diameter monitoring wells will be installed across the plume delineation area. Proposed temporary water table well locations are presented on Figure 1. The wells will be installed prior to the start of the Geoprobe investigation and the groundwater interval sampling (discussed below) to provide time to develop the wells, record water elevations, survey the well head top of casing, and prepare a groundwater flow map. The wells will be installed by direct push methods using a Geoprobe and will be and completed with a 15-foot well screens, concrete collars and locking flush mount covers.

The Geoprobe rig mobilized to install the temporary wells will be equipped with the MIP/EC probe system, which will be used to complete a MIP/EC sounding to the top of the confining layer at each location. Groundwater interval samples will also be collected as described in Task 4. The EC stratigraphic information will be used to select the well screen interval and map the top of the confining layer on a regional level. The MIP/EC data, groundwater laboratory analytical results and the groundwater elevations from the temporary wells will provide a preliminary indication of the groundwater flow direction, stratigraphy, and plume location.

To monitor and document short and long fluctuations in groundwater elevation and subsequent changes in groundwater flow direction, twelve dedicated pressure transducers will be installed to record continuous water level information. The transducers will be installed at selected existing monitoring well locations and the temporary wells described above. The selected locations will be equally spaced across the existing monitoring well network and plume delineation area. Water level data will be downloaded and contoured to document groundwater flow conditions in the investigation area.

Groundwater Monitoring Well Sampling

To provide a current baseline of groundwater contaminant concentrations within the contaminant plume, 16 well nest locations for a total of 42 existing groundwater monitoring wells will be sampled and analyzed for VOCs and natural attenuation parameters. The groundwater contaminant concentrations within the presently identified limits of the plume will be evaluated prior to the delineation field activities to direct the proposed field activities. The laboratory analytical results from both the existing monitoring wells and the in-situ groundwater samples collected by Geoprobe sampling will be integrated into the final interpretation of the horizontal and vertical extent of the contaminant plume.

Geoprobe Investigation and Groundwater Interval Sampling

To delineate the horizontal and vertical extent of the plume, a Geoprobe investigation and Geoprobe groundwater sampling will be completed at the locations presented on Figure 10. The 60 proposed locations encompass the anticipated extent of the plume surrounding the facility. A Geoprobe rig equipped with a MIP/EC probe will provide semi-quantitative/qualitative information on volatile organic compound (VOC) contaminant levels in groundwater and stratigraphy. The real-time VOC contaminant level and stratigraphic data acquired with the MIP/EC probe will be evaluated on-site to select up to three Geoprobe groundwater sample intervals. Geoprobe groundwater samples will be collected to provide OEPA VAP certified laboratory analytical results for the groundwater plume delineation and to confirm the MIP probe results during the investigation. The Geoprobe groundwater samples will be collected using a second Geoprobe drill rig. Groundwater samples will be sent to a DCX partner laboratory for VOC and natural attenuation parameters analysis.

To initiate the plume delineation, the MIP/EC Geoprobe rig will begin sampling within the middle of the groundwater plume. The investigation will progress in a circular pattern around the known extent of the plume to close existing data gaps in the vertical extent of the plume and allow time for the laboratory to analyze the samples. Follow-up sample locations will be determined based on the MIP/EC probe results and laboratory analytical results with the objective to further delineate the leading edge of the plume. Following delineation of the leading edge of the contaminant plume, the remaining investigation locations within the plume would be completed to map the geology and hydrogeology and vertical extent of the contaminant plume.

A review of the site stratigraphy, groundwater flow, and contaminant distribution will be completed prior to demobilization. The objective of this review is to determine if the data collected are sufficient to support a natural attenuation remedy or if additional investigation of the contaminant plume is required. In the event additional investigation locations are selected based on the information review, the required utility clearance and final field investigation activities would be completed.

The Geoprobe groundwater sampling will be completed with a second Geoprobe rig by re-occupying the MIP/EC boring location and advancing an adjacent deep boring to the deepest Geoprobe groundwater sample interval. The deepest interval will be sampled first with progressively more shallow intervals sampled as the drill rods are withdrawn from the borehole. At each interval, the drill rods will be pulled back exposing the well screen to the formation and three volumes of the standing water in the drill rod will be removed by pumping the water from the top of the water column. The sample tubing will then be lowered to the bottom of the well screen and the groundwater purged and sampled. Groundwater samples will be collected with a peristaltic pump using low-flow sampling procedures. Upon completion of groundwater sampling, the second drill rig will seal both boreholes with bentonite grout. Boring locations will be surveyed for x, y, z coordinates by GPS upon completion of the drilling program.

Groundwater samples will be collected for VOC analysis to investigate the horizontal and vertical extent of the contaminant plume and to evaluate contaminant breakdown daughter products. Groundwater samples for natural attenuation parameter analysis will also be collected to evaluate the natural attenuation capacity of the aquifer. The natural attenuation and geochemistry sample parameters include the following:

- Oxidation Reduction Potential (ORP) – by Horiba
- Sulfates / Sulfites
- Nitrates / Nitrites
- Ferrous / Ferric Iron

- Dissolved oxygen (DO) – by Horiba
- PH – by Horiba
- Alkalinity
- Hardness
- Manganese
- Chemical Oxygen Demand (COD) – filtered and unfiltered
- Ethene and Ethane

Data Evaluation, Mapping, and Technical Memoranda

As stated previously, the goal of the proposed plume delineation is to develop sufficient understanding and documentation of existing groundwater conditions to support the design and implementation of a monitored natural attenuation remedy for the off-site groundwater plume. An off-site groundwater summary document and a series of technical memoranda for the plume delineation field activities will be completed following field activities. The off-site groundwater summary document will present an overview of the physical setting (geology and hydrogeology) for the plume and nature of the contaminants present with the objective of (a) evaluating the applicability of a natural attenuation remedy and (b) outlining the data collection requirements for implementation of a monitored natural attenuation remedy. The technical memoranda, which will be appended to the summary document, will contain concise presentations of the information collected during the investigation.

The following is a summary of the technical memoranda that will be prepared to document the existing conditions for the off-site groundwater plume.

- **Geology and Hydrogeology.** This memorandum will contain a compilation of previous and newly collected data on the physical setting in which the plume occurs (contaminant data will be addressed separately). Information presented in the document will include: a summary of the field program completed, electrical conductivity (EC) logs collected Geoprobe boring, up to four geologic cross sections, the final topographic map of the top of the confining layer, boring logs, monitoring well construction diagrams, groundwater level measurement data, groundwater potentiometric maps, a of summary groundwater flow directions and estimated flow rates, and a focused discussion of the geologic and hydrogeologic setting for the off-site plume.
- **Groundwater Plume.** This memorandum will combine previous and newly collected data on the nature of groundwater impacts in the off-site plume. Information presented in this document will include: a summary of the field program completed, tables summarizing membrane interface probe (MIP) measurements collected during Geoprobe borings, tables summarizing contaminant laboratory analytical data, tables summarizing measurement of natural attenuation parameters, up to three maps showing distribution for individual contaminants (and daughter products), up to four cross sections showing contaminant distribution data in profile, and a focused discussion summarizing the extent of the plume, the area of contaminant exceedances, and natural attenuation parameters.

Figures

Figure 1 – Site Location Map

Figure 2 – Primary Soil Contaminant Source Area

Figure 3 – SVE Pilot Scale Testing Results

Figure 4 – SVE System Layout

Figure 5 – SVE Process Flow and Instrumentation Diagram

Figure 6 – Groundwater System Layout

Figure 7 – Groundwater Flow Path – Normal Conditions

Figure 8 – Groundwater Piping Layout

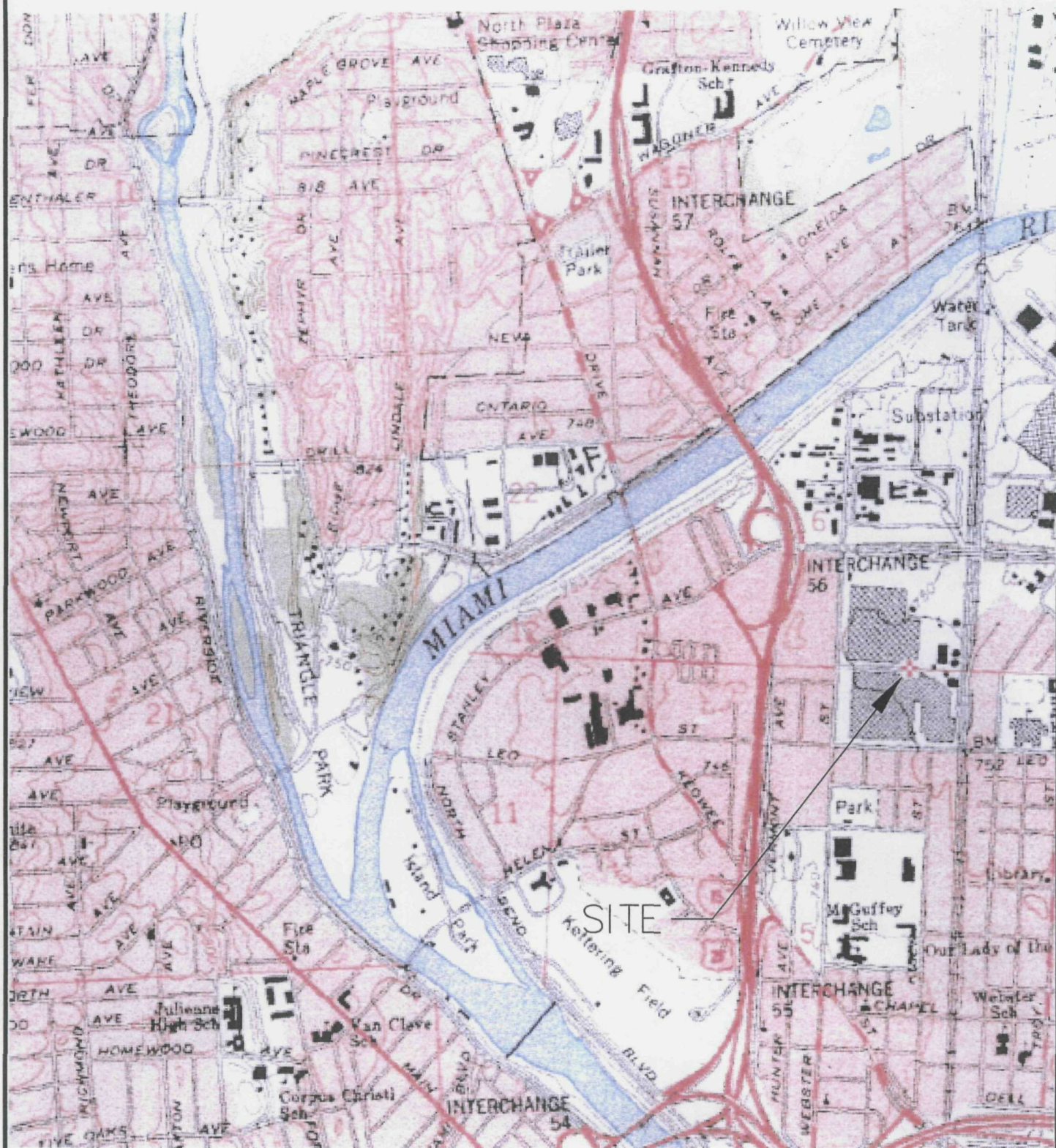
Figure 9 – Groundwater Process Flow and Instrumentation Diagram

Figure 10 – Groundwater Plume Delineation Proposed Sample Locations

Appendices

Appendix A - Hydraulic Conductivity Technical Memorandum

Appendix B - Geochemistry Technical Memorandum

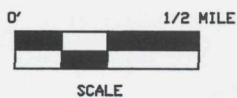
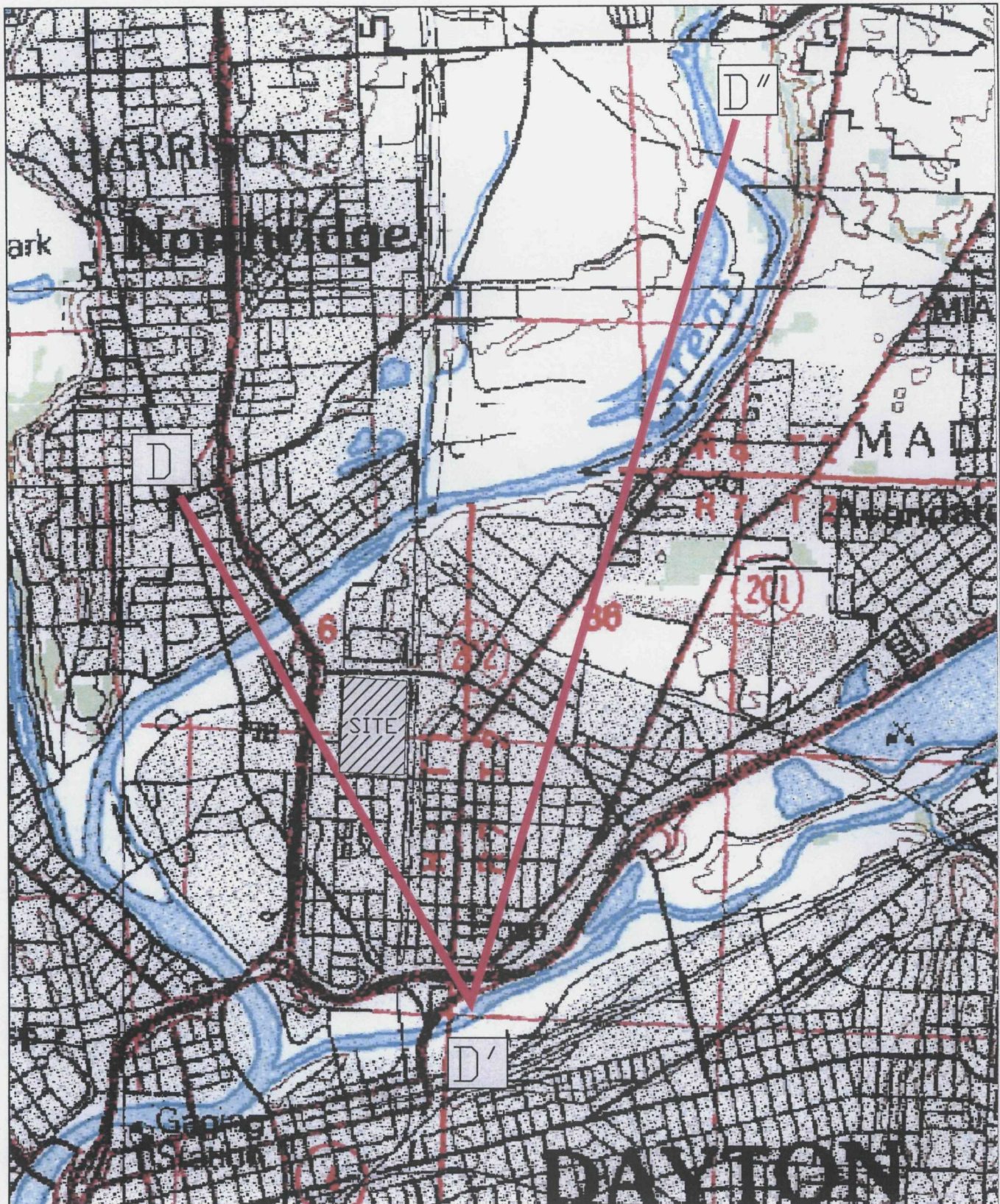


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FIGURE 1
VICINITY MAP
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

DRAWN BY: JRD	EDITED BY: JRD	PROJECT NUMBER: 55465	FILE NAME:
CHECKED BY: JE	DATE: DEC. 20, 2002	SCALE:	WELL PLACEMENT REV1



SOURCE: USGS DAYTON, OHIO, UNITED STATES 01 JULY 1984

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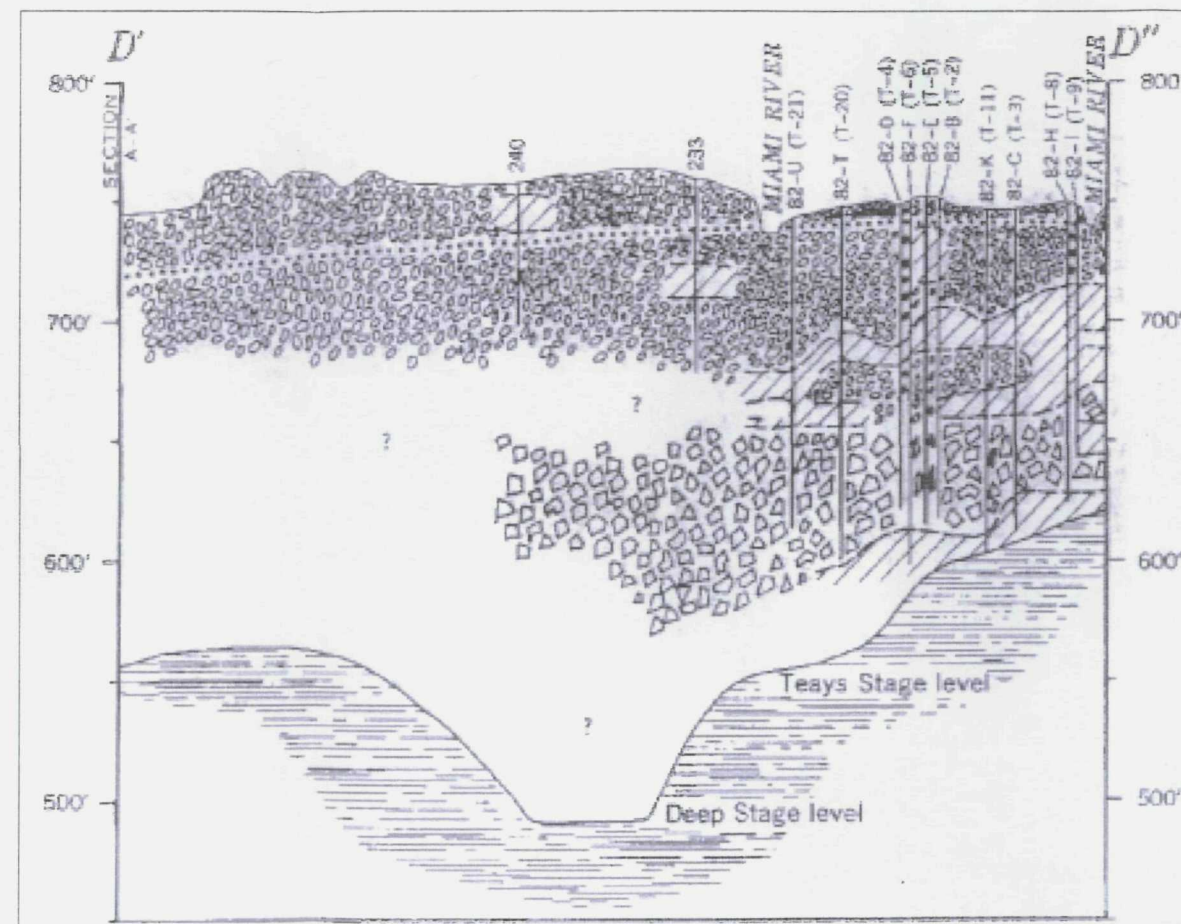
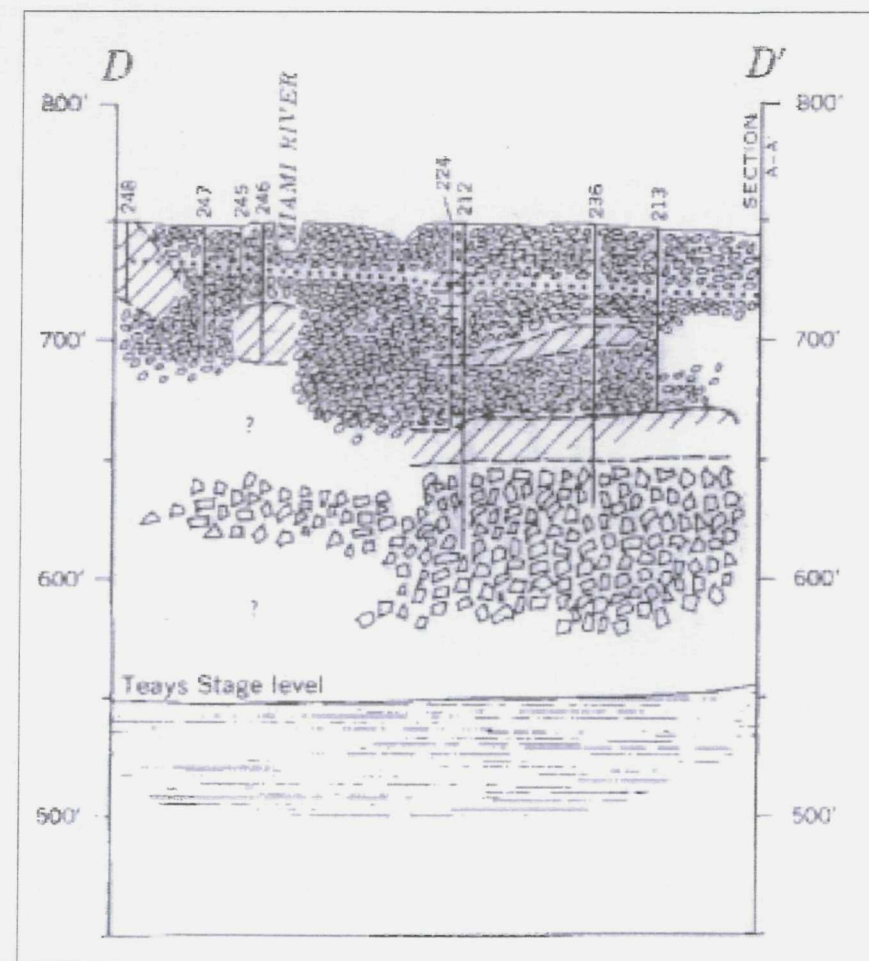
DRAWN BY: JRD
CHECKED BY: JK

EDITED BY: JRD
DATE: MARCH 12, 2003

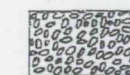
PROJECT NUMBER: 55465
SCALE: 2" = 1 MILE

FILE NAME:
USGS X-LOCATOR

USGS
GEOLOGICAL CROSS-SECTION
LOCATOR MAP
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

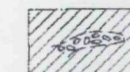


EXPLANATION



Upper aquifer

Sand and gravel deposits occurring at or near the surface; generally overlies the till-rich zone



Till-rich zone

Fairly widespread sheets, lenses, and masses of till; contains pockets and lenses of sand and gravel; occurs as a layer of low permeability and generally separates the sand and gravel deposits into an upper and a lower aquifer



Lower aquifer

Sand and gravel deposits generally occurring between the till-rich zone and bedrock; contains interbedded lenses and masses of till and clay, especially near the bedrock surface



Shale of Ordovician age with thin interbedded limestone layers

Geologic contact

Dashed where approximate

Piezometric surface in lower aquifer

Based on water-level measurements made in October 1959; represents the water table where the till-rich zone is absent. Datum is mean sea level

250

Well

Number refers to well listed in the section "Records of Wells in the Dayton Area"



SCALE

SOURCE: GROUND-WATER RESOURCES OF THE DAYTON AREA, OHIO (USGS DOCUMENT)

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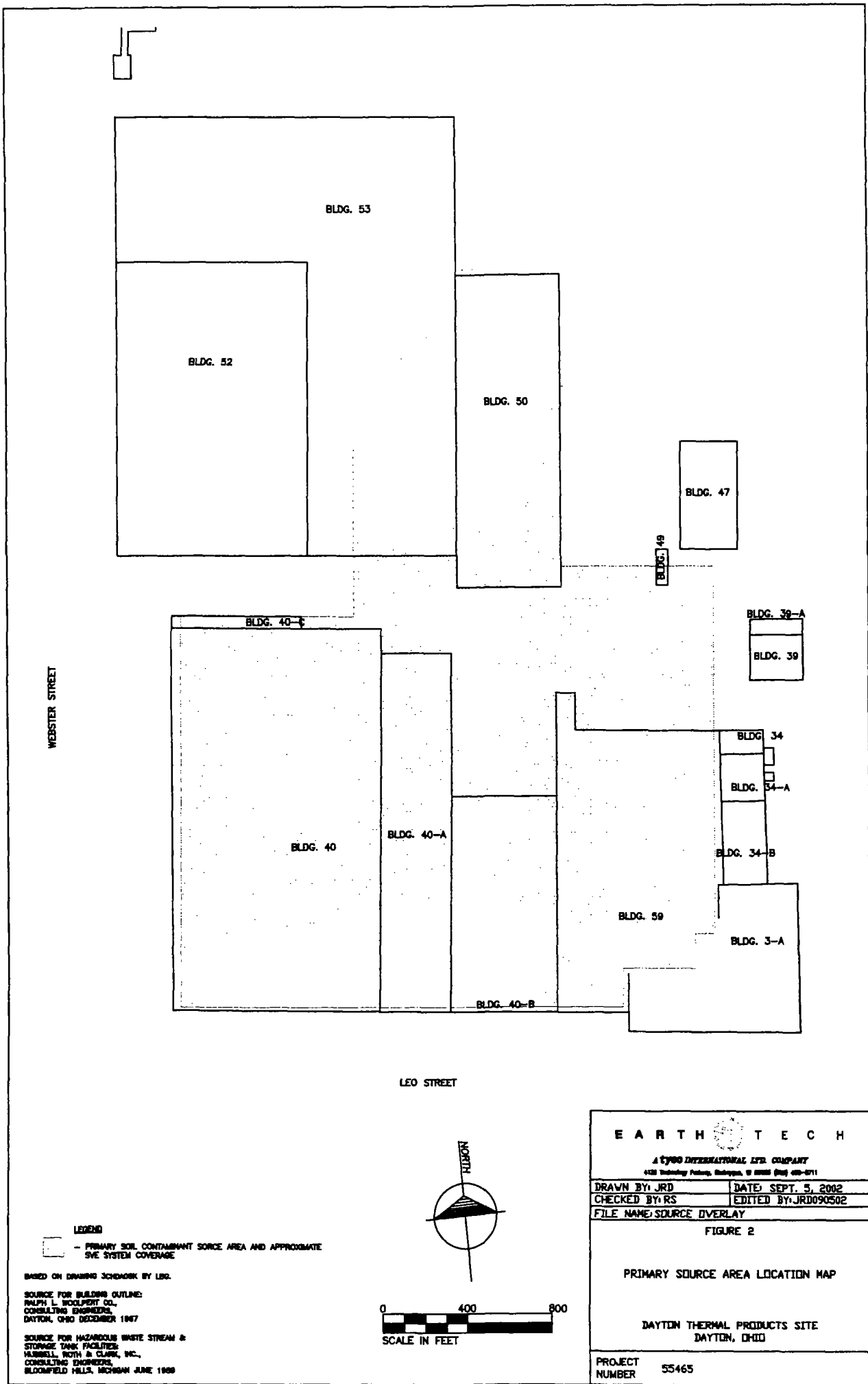
DRAWN BY: JRD
CHECKED BY: RS

EDITED BY: JRD
DATE: March 11, 2003

USGS GEOLOGICAL CROSS-SECTIONS

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT NUMBER: 55465
SCALE: -----
FILE NAME: USGS Cross Sections







WEBSTER STREET



LEO STREET

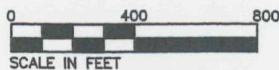
SVE POINT LEGEND

-  - > 15 LBS/MONTH VOC PRODUCTION @ 100 SCFM
-  - 5 - 15 LBS/MONTH VOC PRODUCTION @ 100 SCFM
-  - < 5 LBS/MONTH VOC PRODUCTION @ 100 SCFM
-  - PRIMARY SOIL CONTAMINANT SOURCE AREA AND APPROXIMATE SVE SYSTEM COVERAGE

BASED ON DRAWING 3CHDA08K BY LBG.

SOURCE FOR BUILDING OUTLINE:
RALPH L. WOOLPERT CO.,
CONSULTING ENGINEERS,
DAYTON, OHIO DECEMBER 1967

SOURCE FOR HAZARDOUS WASTE STREAM &
STORAGE TANK FACILITIES:
HUBBELL, ROTH & CLARK, INC.,
CONSULTING ENGINEERS,
BLOOMFIELD HILLS, MICHIGAN JUNE 1989



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A tycoo INTERNATIONAL LTD. COMPANY
4128 Technology Parkway, Shelton, CT 06484 (203) 486-0711

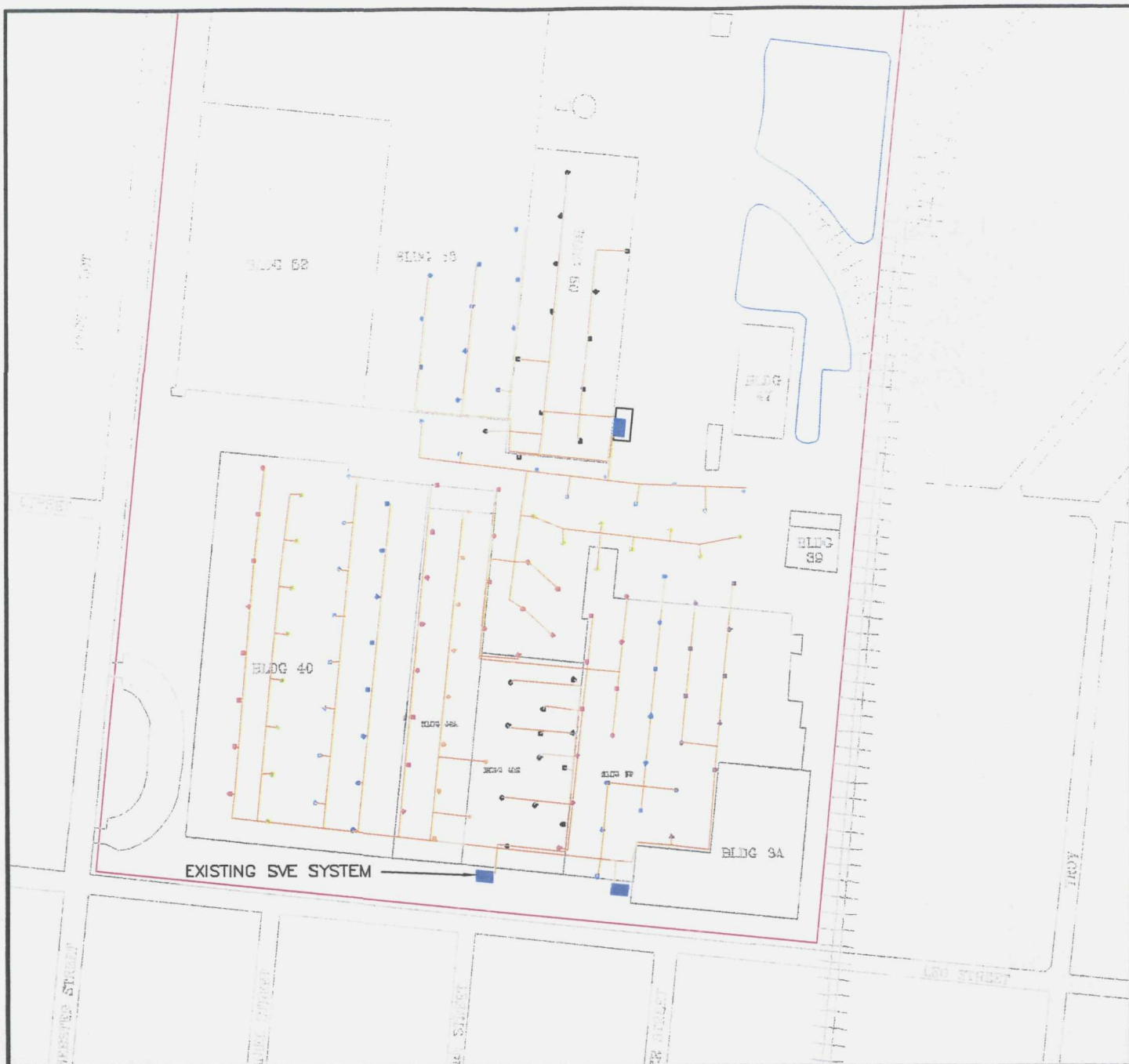
DRAWN BY: JRD	DATE: SEPT. 5, 2002
CHECKED BY: RS	EDITED BY: JRD090502
FILE NAME: SOURCE OVERLAY	

FIGURE 3

SVE PILOT AND EXISTING WELL LOCATIONS

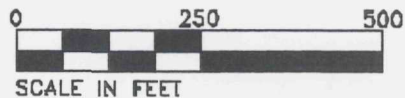
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT
NUMBER 55465



LEGEND

- - EXISTING SVE WELL PAIR (SHALLOW AND DEEP)
- - NEW WELLS (COLORS INDICATE BANKS)
- SVE PIPING
- - SVE SYSTEM BUILDING



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DRAWN BY: JRD

DATE: SEPT. 11, 2002

CHECKED BY: JE

EDITED BY: JRD091102

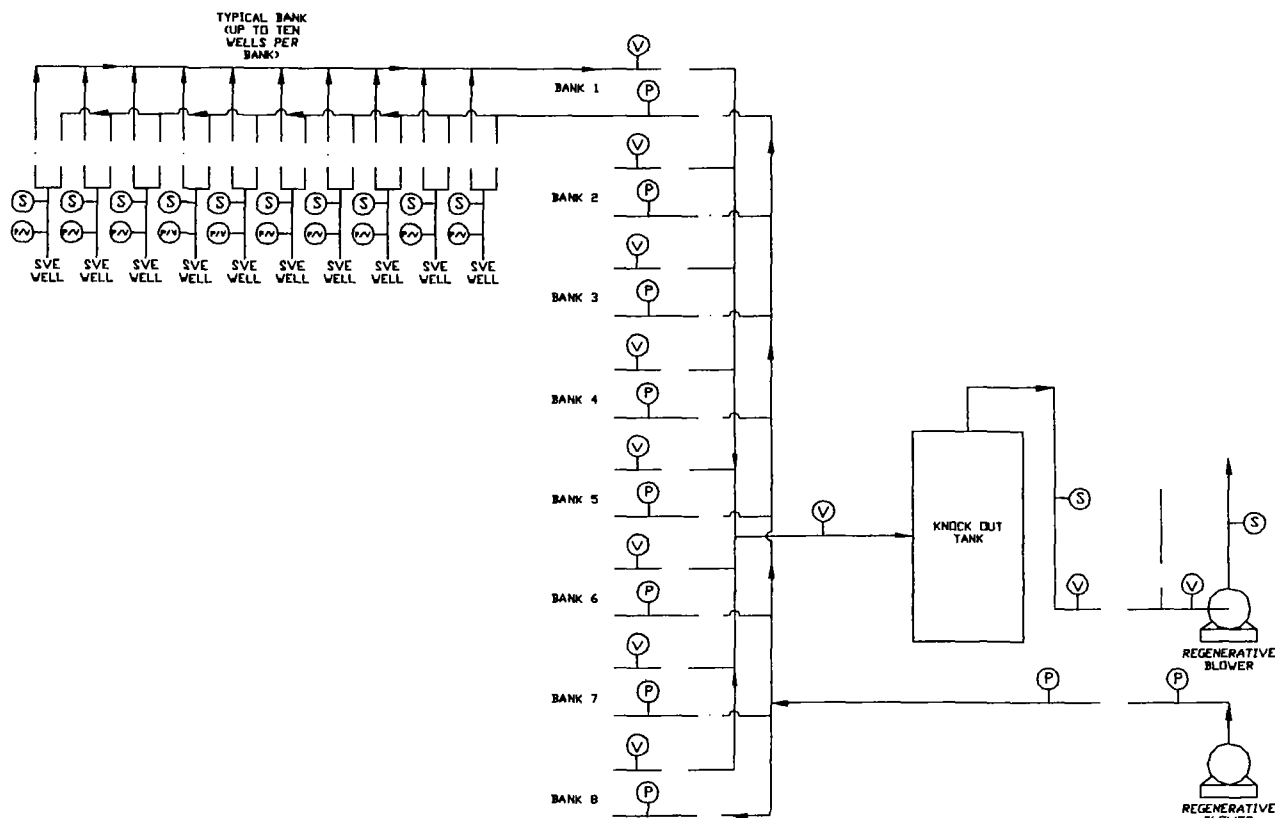
FILE NAME: BUILDING 40B SYSTEM

FIGURE 4

SVE SYSTEM LAYOUT
WELL AND PIPING LOCATION

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT
NUMBER 55465



LEGEND

- COMBINED PRESSURE VACUUM GAUGE/SENSOR
- PRESSURE GAUGE/SENSOR
- VACUUM GAUGE/SENSOR
- SAMPLE PORT/PARAMETER SENSOR
- THROTTLE VALVE
- ISOLATION VALVE
- MOTORIZED BUTTERFLY VALVE
- EXTRACTION PIPING
- INJECTION PIPING

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4185 Technology Parkway, Shelton, CT 06484 (203) 485-8111

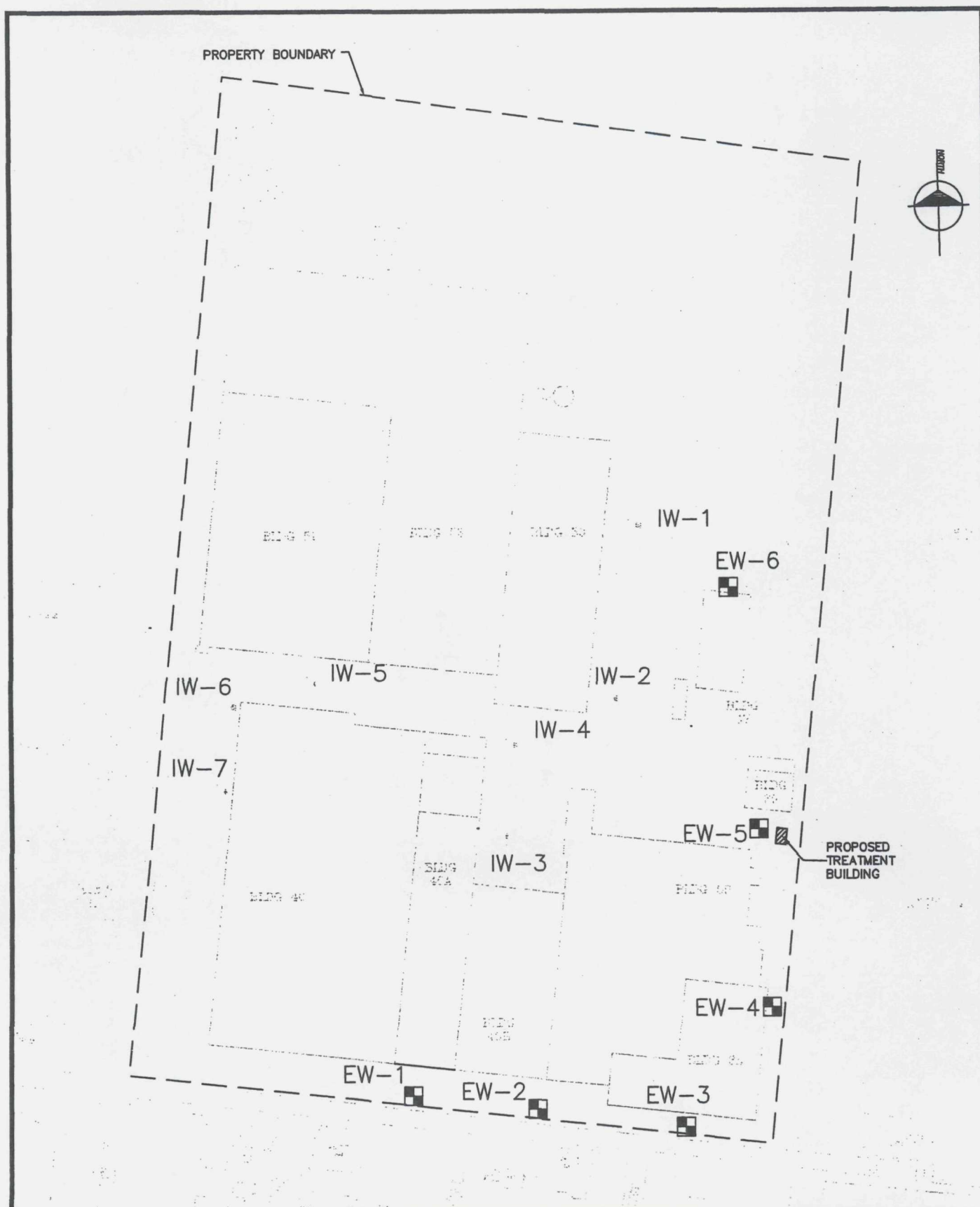
DRAWN BY: JRD	DATE: JULY 8, 2002
CHECKED BY: JE	EDITED BY: JRD070802
FILE NAME: GW PIDs	

FIGURE 5

SOIL VAPOR EXTRACTION
PROCESS FLOW AND INSTRUMENTATION
DIAGRAM

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

PROJECT
NUMBER 55465



LEGEND

- - PROPOSED INJECTION WELLS
- - PROPOSED EXTRACTION WELLS

E A R T H T E C H

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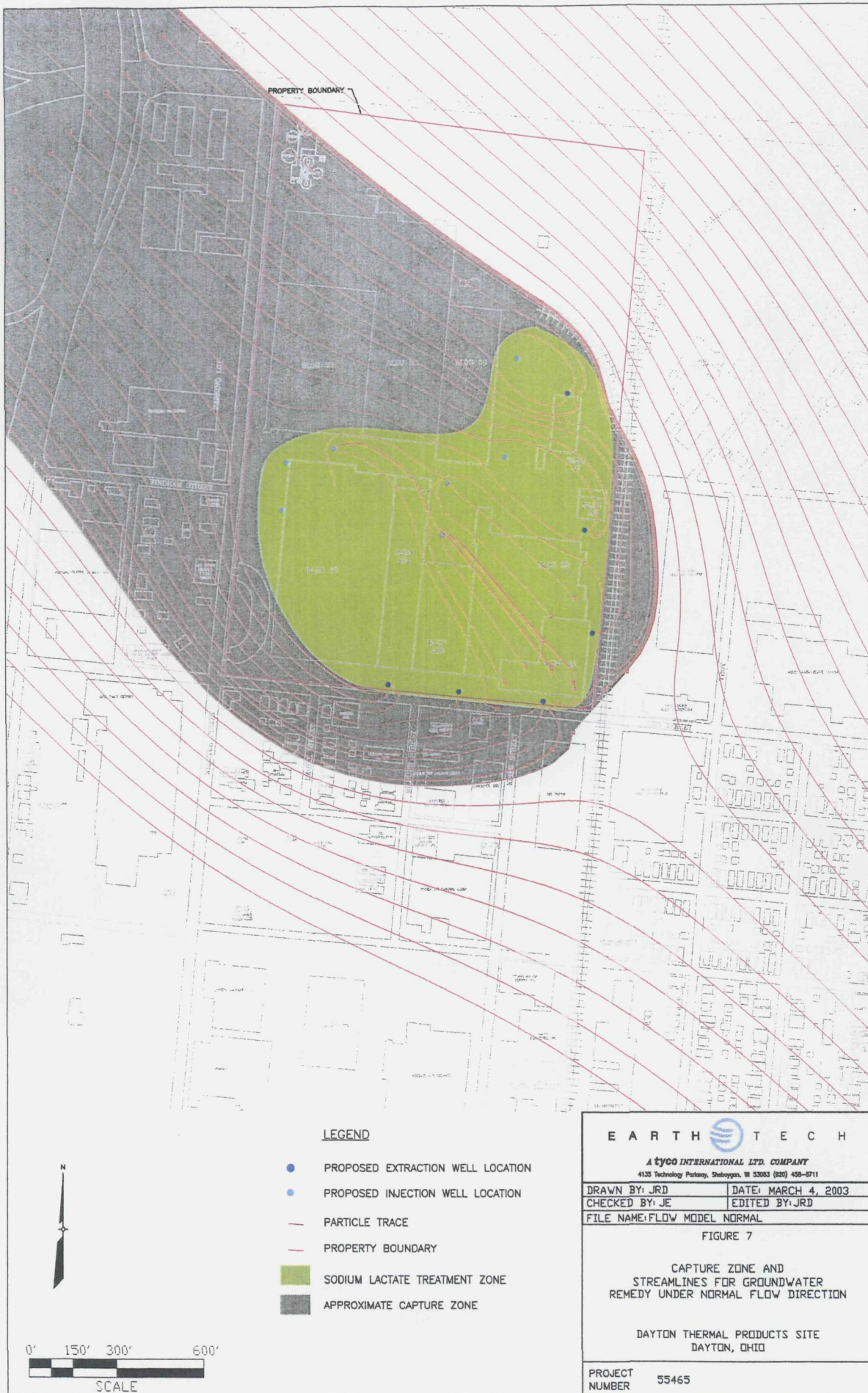
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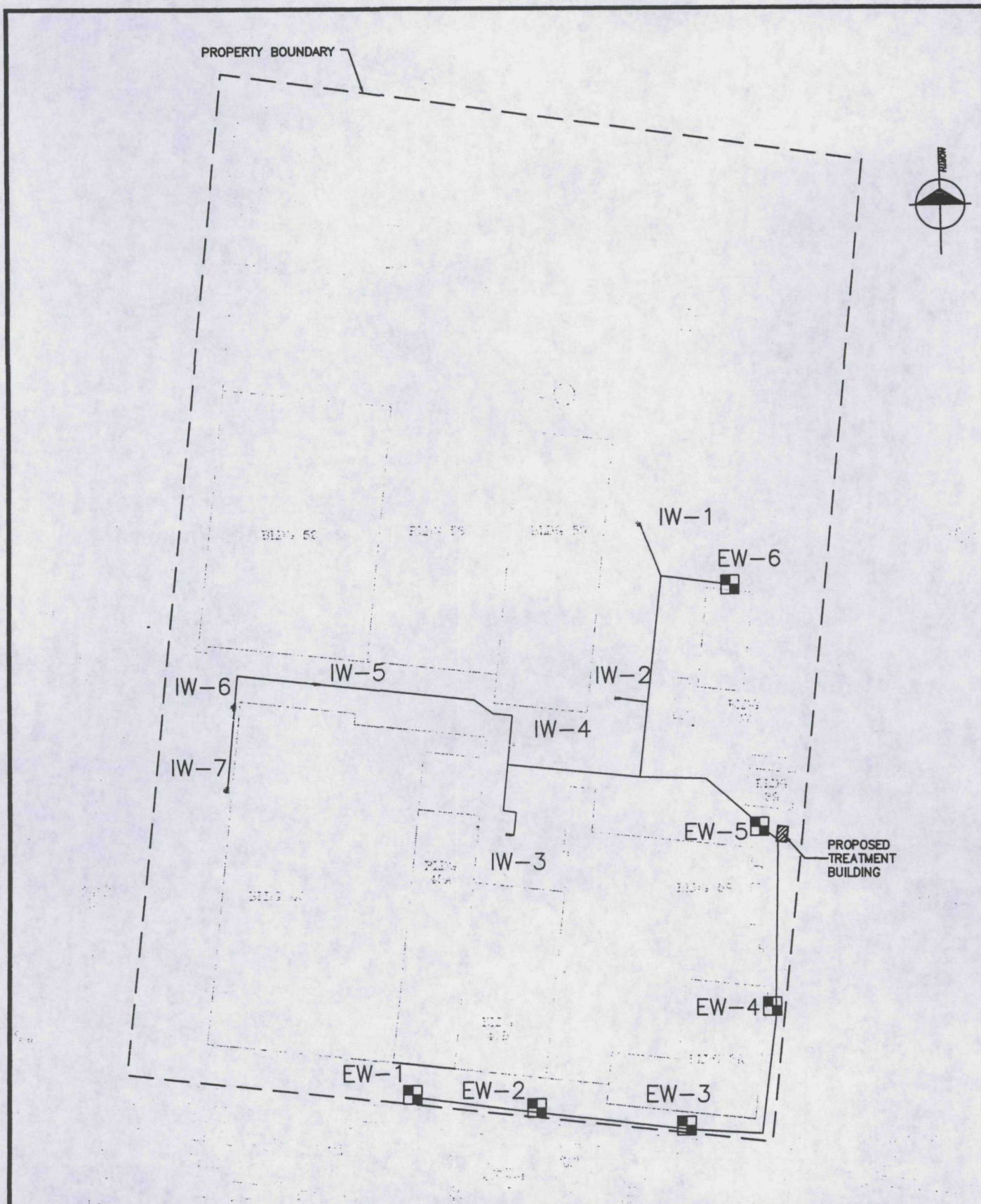
EDITED BY: JRD
DATE: MARCH 4, 2003

PROJECT NUMBER: 55465
SCALE: 1/250

FILE NAME:
WELLS.DWG

FIGURE 6
WELL LOCATIONS
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO





LEGEND

- PROPOSED INJECTION WELLS
- PROPOSED EXTRACTION WELLS
- TRENCH AND PIPE

EARTH TECH

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4135 TECHNOLOGY PARKWAY, SHEBOYGAN, WISCONSIN 53083

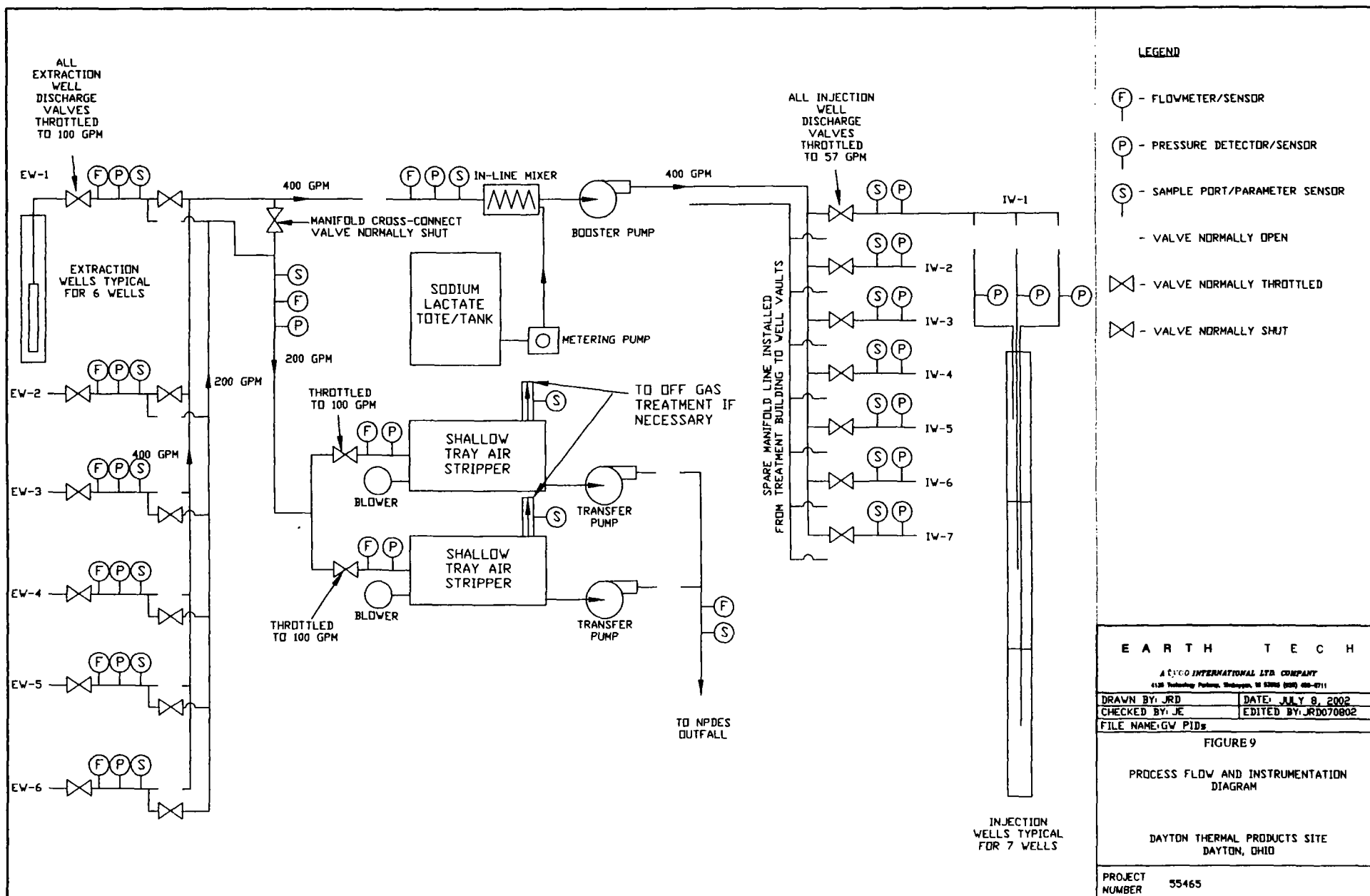
**FIGURE 8
WELL LOCATIONS
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO**

DRAWN BY: JRD
CHECKED BY: JE

EDITED BY: JRD
DATE: MARCH 4, 2003

PROJECT NUMBER: 55465
SCALE: 1:250

FILE NAME:
WELLS.DWG





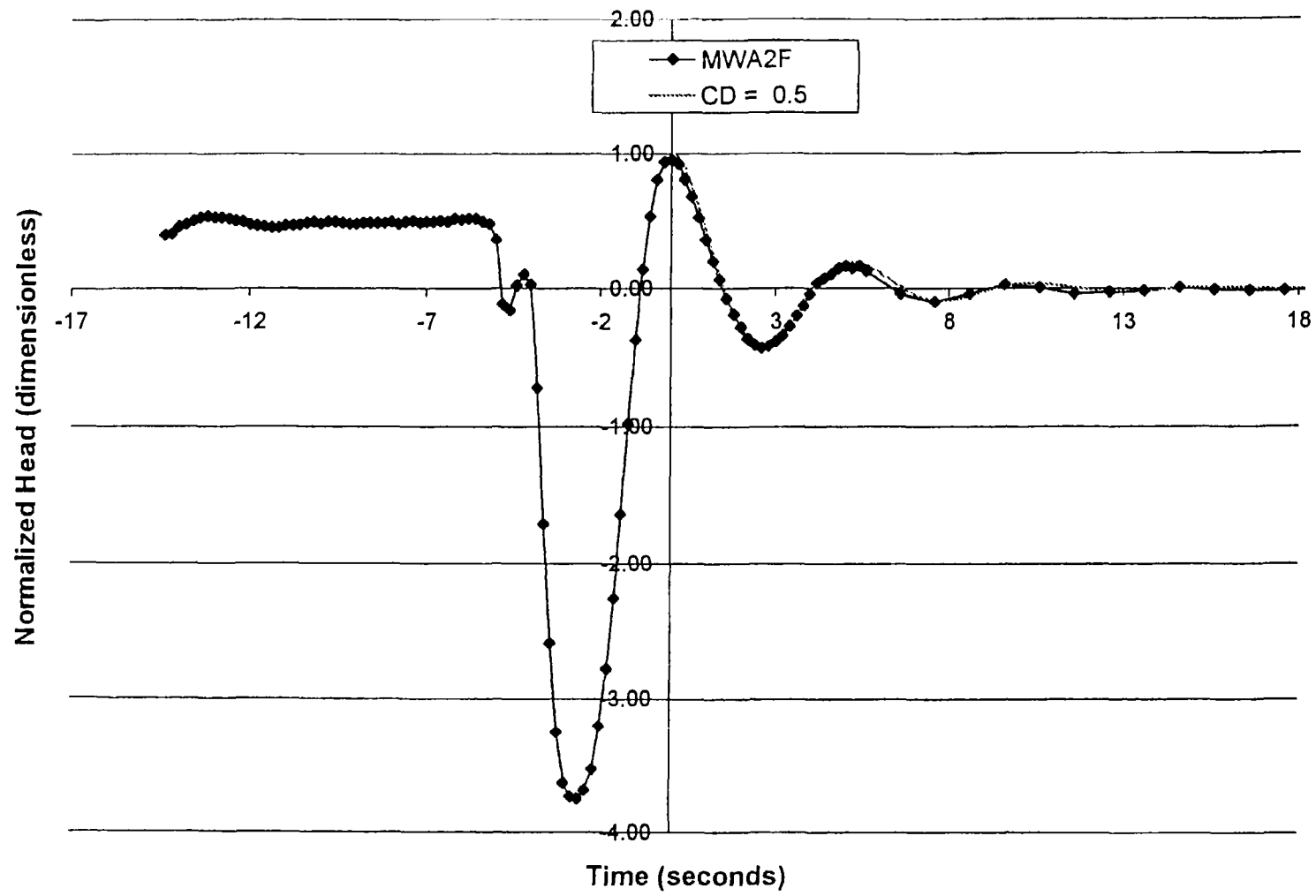
Appendix A - Hydraulic Conductivity Technical Memorandum

MARCH 4, 2003

MW-A2
Falling Head

	L	M	N	O	P	Q	R	S	I	U	V	W
1												
2			Best Fit				Confined - High-K Hvorslev Model					
3	Time		Type Curve									
4	Correlation Ratio		C_D				$K_r =$	$t_d^* r_c^2 \ln[b/(2r_w^*) + (1 + (b/(2r_w^*))^2)^{0.5}]$				
5	t_d^*/t^*		0.5					t^*	$2bC_D$			
6	1.250											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	20.61 ft				$K_r =$ 2.79E-03 ft/sec 2.41E+02 ft/day 7.35E+01 m/day 8.51E-02 cm/sec					
9	nominal	Le =	11.77 ft									
10	% difference		75%									
11												
12												
13	Modulation Factor =		0.800				Unconfined - High-K Bouwer and Rice Model					
14												
15							$K_r =$	$t_d^* r_c^2 \ln[R_e/r_w^*]$				
16	Dimensionless	$C_D =$		Adjusted				t^*	$2bC_D$			
17	Time	0.5		Time								
18	0	1		0			$\ln(R_e/r_w^*) =$	2.322		$A =$	2.359	
19	0.1	0.995086		0.0800						$B =$	0.373	
20	0.2	0.980714		0.1600				first term	$1.1/(\ln((d+b)/r_w^*))$			
21	0.3	0.957485		0.2400					0.272			
22	0.4	0.926057		0.3200				second term	$(A + B^*(\ln((B - (d+b))/r_w^*))) / (b/r_w^*)$			
23	0.5	0.887137		0.4000					0.159			
24	0.6	0.841468		0.4800				$\ln((B - (d+b))/r_w^*)$	5.049			
25	0.7	0.789826		0.5600						Cannot exceed 6.		
26	0.8	0.733005		0.6400						See Butler (1997) - p.108.		
27	0.9	0.671812		0.7200								
28	1	0.607055		0.8000			$K_r =$ 1.97E-03 ft/sec 1.71E+02 ft/day 5.20E+01 m/day 6.03E-02 cm/sec					
29	1.1	0.53954		0.8800								
30	1.2	0.47006		0.9600								

Curve Matching



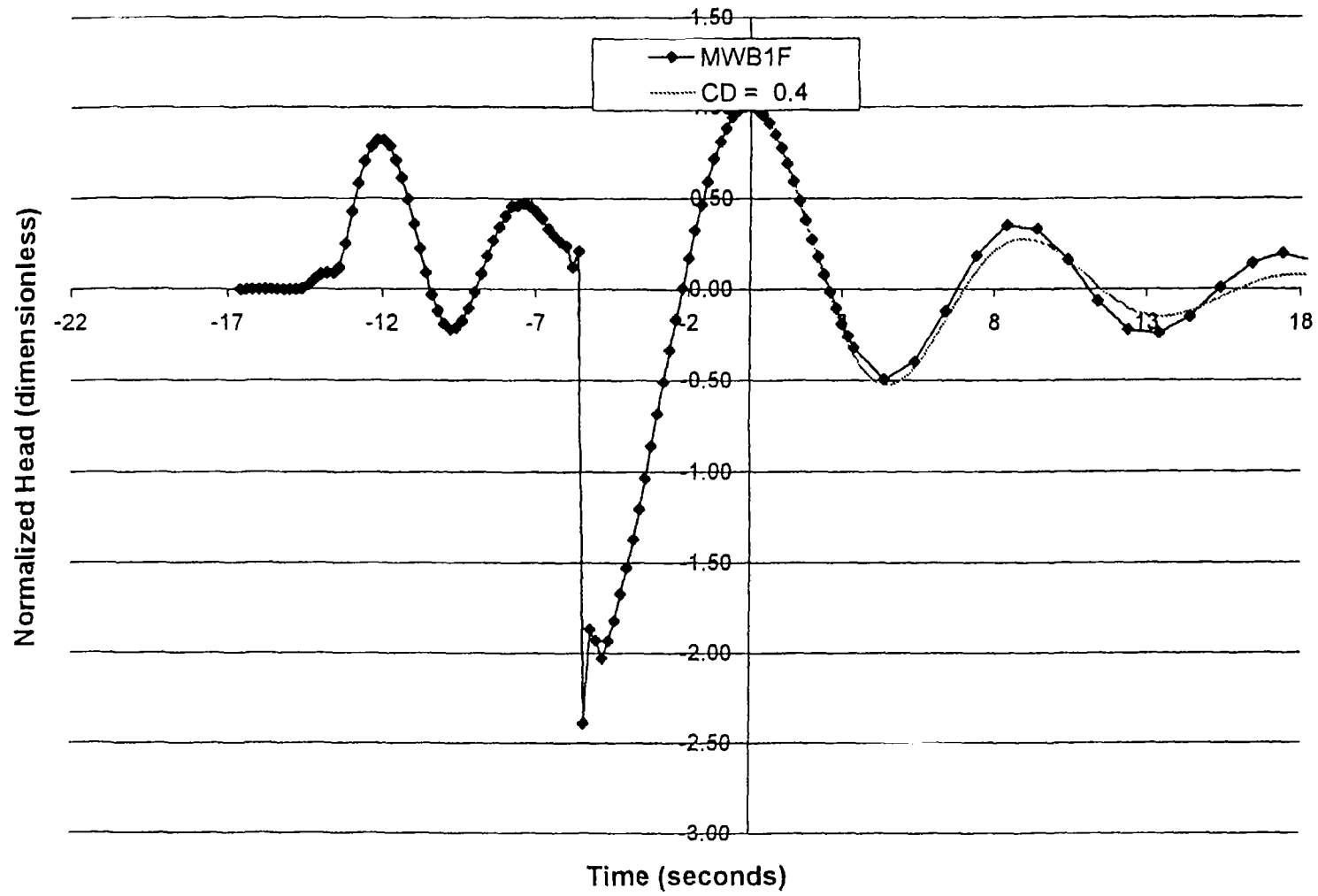
MW-B1
Rising Head

	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			Best Fit				Confined - High-K Hvorslev Model					
3	Time		Type Curve									
4	Correlation Ratio		C_D				$K_r =$	$t_d^* r_c^2 \ln[b/(2r_w^*) + (1 + (b/(2r_w^*))^2)^{0.5}]$				
5	t_d^*/t^*		0.4				t^*	$2bC_D$				
6	0.714											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	63.11 ft									
9	nominal	Le =	51.31 ft				K_r = 1.99E-03 ft/sec 1.72E+02 ft/day 5.25E+01 m/day 6.08E-02 cm/sec					
10	% difference		23%									
11												
12												
13	Modulation Factor =		1:400				Unconfined - High-K Bouwer and Rice Model					
14												
15							$K_r =$	$t_d^* r_c^2 \ln[R_e/r_w^*]$				
16	Dimensionless	C_D =		Adjusted			t^*	$2bC_D$				
17	Time	0.4		Time								
18	0	1		0			$\ln(R_e/r_w^*) =$	2.939		A =	2.359	
19	0.1	0.99507		0.1400						B =	0.373	
20	0.2	0.980587		0.2800				first term	$1.1/(\ln((d+b)/r_w^*))$			
21	0.3	0.957068		0.4200					0.209			
22	0.4	0.925097		0.5600				second term	$(A + B * (\ln[(B - (d+b))/r_w^*])) / (b/r_w^*)$			
23	0.5	0.885319		0.7000					0.131			
24	0.6	0.838429		0.8400				$\ln[(B - (d+b))/r_w^*]$	3.051			
25	0.7	0.785166		0.9800						Cannot exceed 6.		
26	0.8	0.726301		1.1200						See Butler (1997) - p.108.		
27	0.9	0.66263		1.2600								
28	1	0.594966		1.4000			K_r = 1.78E-03 ft/sec 1.54E+02 ft/day 4.70E+01 m/day 5.45E-02 cm/sec					
29	1.1	0.524128		1.5400								
30	1.2	0.450934		1.6800								

MW-B1
Falling Head

	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			Best Fit				Confined - High-K Hvorslev Model					
3	Time		Type Curve									
4	Correlation Ratio		C_D				$K_r =$	$t_d^* r_c^2 \ln[b/(2r_w^*) + (1 + (b/(2r_w^*))^2)^{0.5}]$				
5	t_d^*/t^*		0.4				t^*	$2bC_D$				
6	0.714											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	63.11 ft									
9	nominal	Le =	51.31 ft				$K_r =$ 1.99E-03 ft/sec 1.72E+02 ft/day 5.25E+01 m/day 6.08E-02 cm/sec					
10	% difference		23%									
11												
12												
13	Modulation Factor =		1.400				Unconfined - High-K Bouwer and Rice Model					
14												
15							$K_r =$	$t_d^* r_c^2 \ln[R_e/r_w^*]$				
16	Dimensionless	$C_D =$		Adjusted			t^*	$2bC_D$				
17	Time	0.4		Time								
18	0	1		0			$\ln(R_e/r_w^*) =$	2.939		$A =$	2.359	
19	0.1	0.99507		0.1400						$B =$	0.373	
20	0.2	0.980587		0.2800				first term	$1.1/(\ln((d+b)/r_w^*))$			
21	0.3	0.957068		0.4200					0.209			
22	0.4	0.925097		0.5600				second term	$(A + B^*(\ln[(B - (d+b))/r_w^*]))/(b/r_w^*)$			
23	0.5	0.885319		0.7000						0.131		
24	0.6	0.838429		0.8400				$\ln[(B - (d+b))/r_w^*]$		3.051		
25	0.7	0.785166		0.9800						Cannot exceed 6.		
26	0.8	0.726301		1.1200						See Butler (1997) - p.108.		
27	0.9	0.66263		1.2600								
28	1	0.594966		1.4000			$K_r =$ 1.78E-03 ft/sec 1.54E+02 ft/day 4.70E+01 m/day 5.45E-02 cm/sec					
29	1.1	0.524128		1.5400								
30	1.2	0.450934		1.6800								

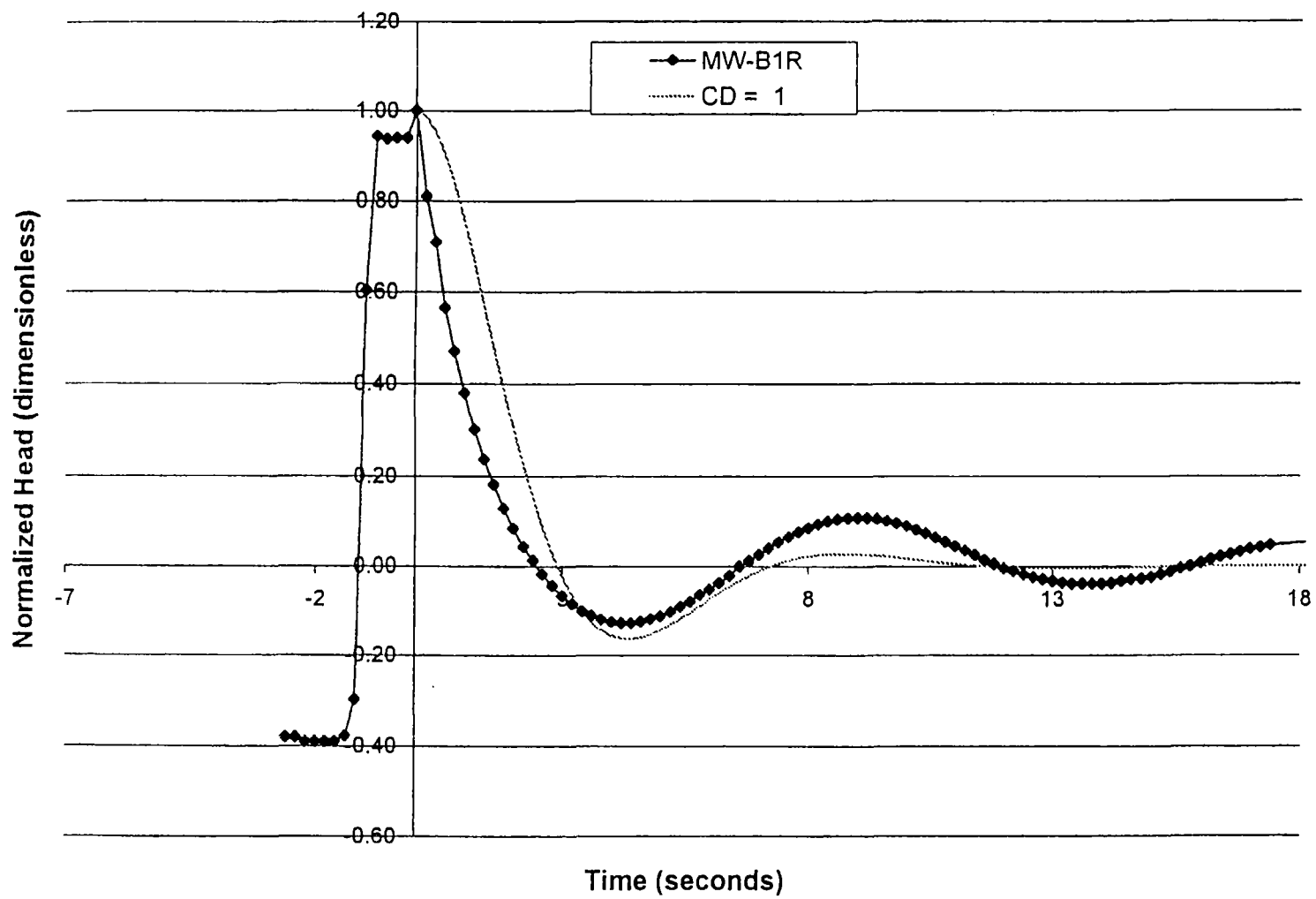
Curve Matching



MW-B1
Rising Head

	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			Best Fit				Confined - High-K Hvorslev Model					
3	Time		Type Curve									
4	Correlation Ratio		C_D				$K_r =$	$t_d^* r_c^2 \ln[b/(2r_w^*) + (1 + (b/(2r_w^*))^2)^{0.5}]$				
5	t_d^*/t^*		1				t^*	$2bC_D$				
6	0.833											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	46.37 ft									
9	nominal	Le =	51.31 ft				$K_r =$ 9.31E-04 ft/sec 8.04E+01 ft/day 2.45E+01 m/day 2.84E-02 cm/sec					
10	% difference		10%									
11												
12												
13	Modulation Factor =		1.200				Unconfined - High-K Bouwer and Rice Model					
14												
15							$K_r =$	$t_d^* r_c^2 \ln[R_e/r_w^*]$				
16	Dimensionless	$C_D =$		Adjusted			t^*	$2bC_D$				
17	Time	1		Time								
18	0	1		0			$\ln(R_e/r_w^*) =$	2.939		$A =$	2.359	
19	0.1	0.995167		0.1200						$B =$	0.373	
20	0.2	0.981331		0.2400				first term	$1.1/(\ln((d+b)/r_w^*))$			
21	0.3	0.959481		0.3600					0.209			
22	0.4	0.930587		0.4800				second term	$(A + B^*(\ln[(B - (d+b))/r_w^*]))/(b/r_w^*)$			
23	0.5	0.895595		0.6000					0.131			
24	0.6	0.855416		0.7200				$\ln[(B - (d+b))/r_w^*]$	3.051			
25	0.7	0.810928		0.8400						Cannot exceed 6.		
26	0.8	0.762963		0.9600						See Butler (1997) - p.108.		
27	0.9	0.712308		1.0800								
28	1	0.6597		1.2000			$K_r =$ 8.33E-04 ft/sec 7.19E+01 ft/day 2.19E+01 m/day 2.54E-02 cm/sec					
29	1.1	0.605826		1.3200								
30	1.2	0.551319		1.4400								

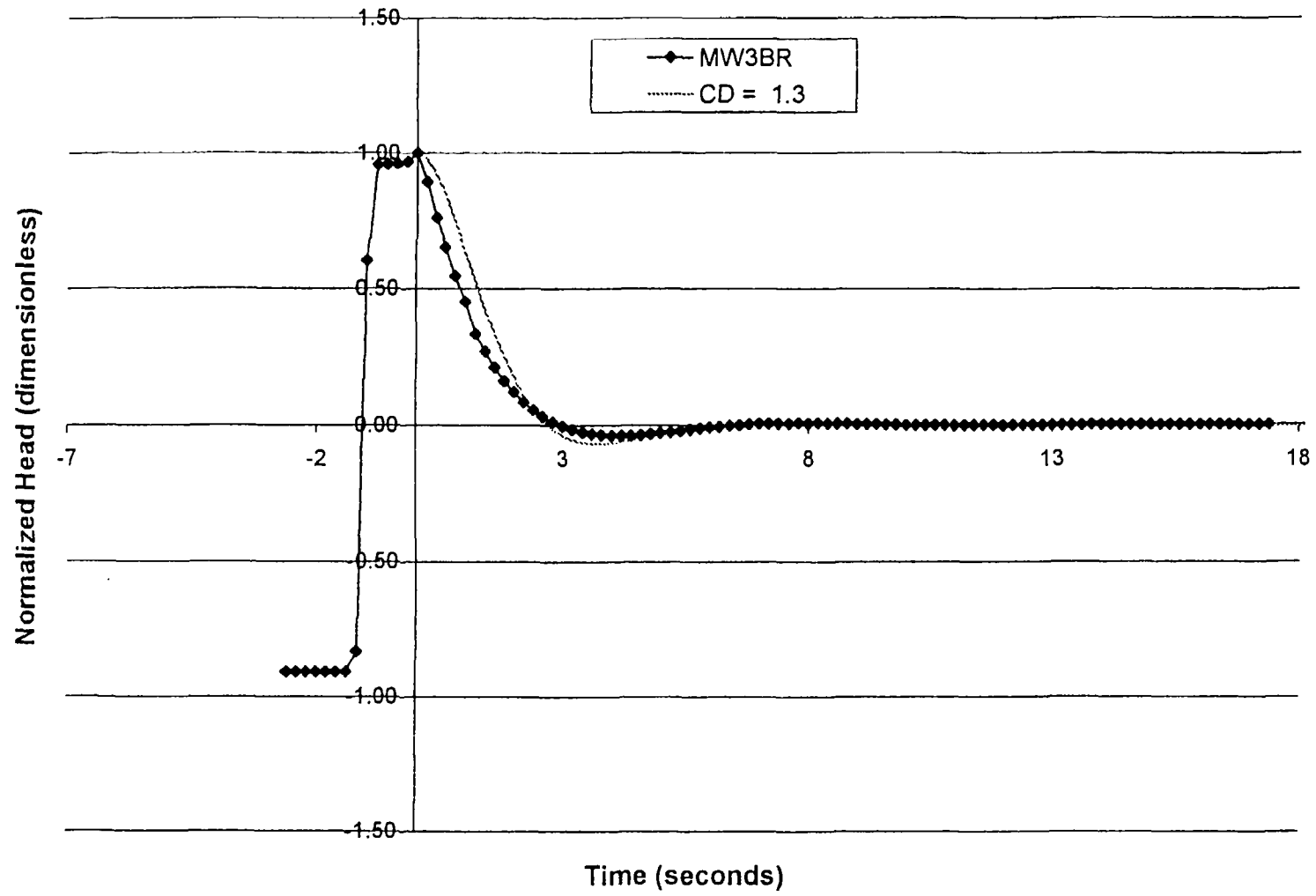
Curve Matching



MW-B3
Rising Head

	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			Best Fit				Confined - High-K Hvorslev Model					
3	Time		Type Curve									
4	Correlation Ratio		C_D				$K_r =$	$t_d^* r_c^2 \ln[b/(2r_w^*) + (1 + (b/(2r_w^*))^2)^{0.5}]$				
5	t_d^*/t^*		1.3				t^*	$2bC_D$				
6	1.111											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	26.08	ft			<div style="border: 1px solid black; padding: 5px;"> $K_r =$ 9.55E-04 ft/sec 8.25E+01 ft/day 2.51E+01 m/day 2.91E-02 cm/sec </div>					
9	nominal	Le =	25.97	ft								
10	% difference		0%									
11												
12												
13	Modulation Factor =		0.900				Unconfined - High-K Bouwer and Rice Model					
14												
15							$K_r =$	$t_d^* r_c^2 \ln[R_e/r_w^*]$				
16	Dimensionless	$C_D =$		Adjusted			t^*	$2bC_D$				
17	Time	1.3		Time								
18	0	1		0			$\ln(R_e/r_w^*) =$	2.522		$A =$	2.359	
19	0.1	0.995214		0.0900						$B =$	0.373	
20	0.2	0.981686		0.1800				first term	$1.1/(\ln((d+b)/r_w^*))$			
21	0.3	0.96061		0.2700					0.241			
22	0.4	0.933103		0.3600				second term	$(A + B^*(\ln[(B - (d+b))/r_w^*]))/(b/r_w^*)$			
23	0.5	0.900206		0.4500					0.155			
24	0.6	0.862885		0.5400				$\ln[(B - (d+b))/r_w^*]$	4.771			
25	0.7	0.822029		0.6300						Cannot exceed 6.		
26	0.8	0.778451		0.7200						See Butler (1997) - p.108.		
27	0.9	0.732893		0.8100								
28	1	0.686021		0.9000			<div style="border: 1px solid black; padding: 5px;"> $K_r =$ 7.33E-04 ft/sec 6.33E+01 ft/day 1.93E+01 m/day 2.24E-02 cm/sec </div>					
29	1.1	0.638435		0.9900								
30	1.2	0.590669		1.0800								

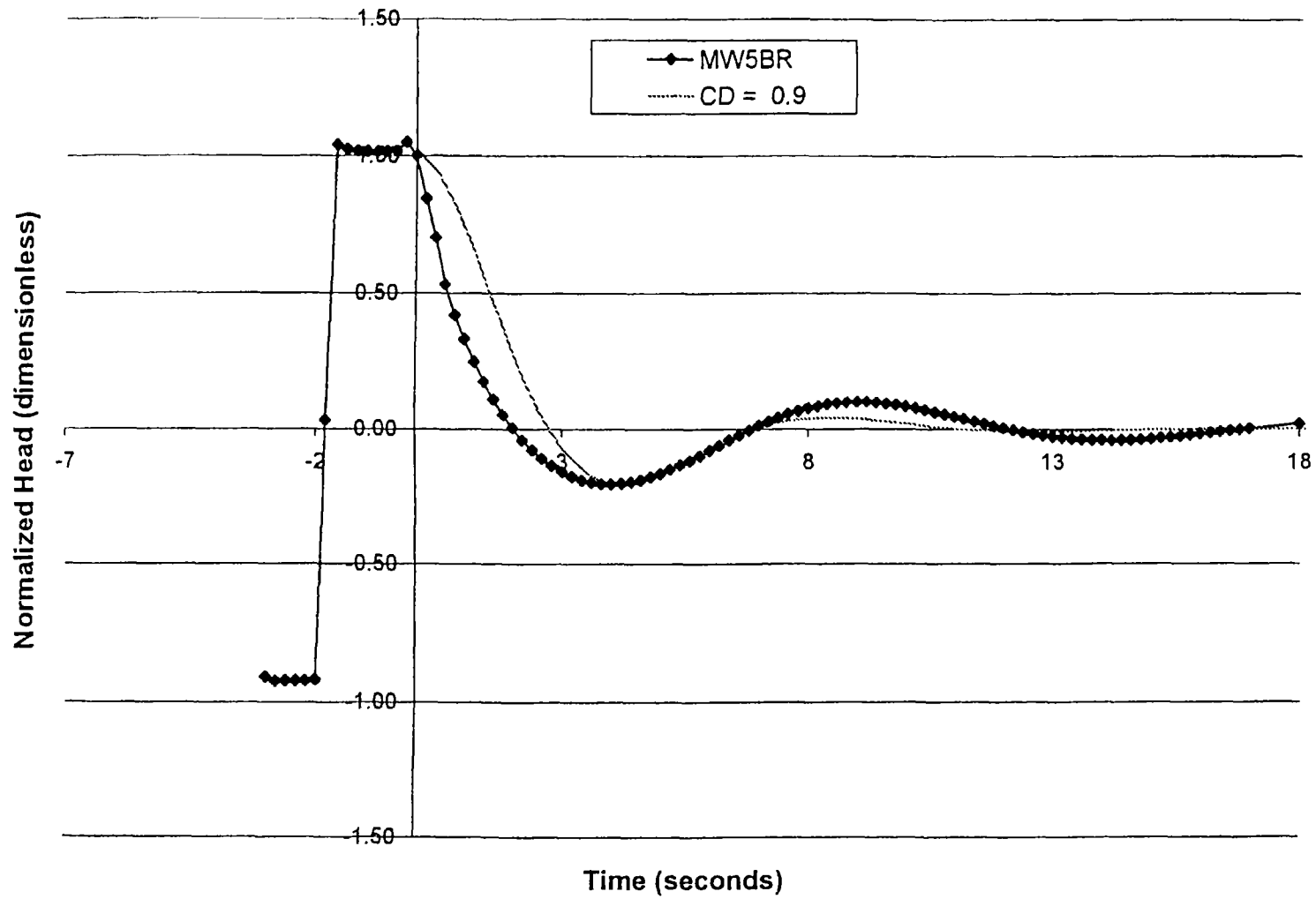
Curve Matching



MW-B5
Rising Head

	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			Best Fit				Confined - High-K Hvorslev Model					
3	Time		Type Curve									
4	Correlation Ratio		C_D				$K_r = t_d^* r_c^2 \ln[b/(2r_w^*) + (1 + (b/(2r_w^*))^2)^{0.5}]$					
5	t_d*/t*		0.9				t*	2bC _D				
6	0.833											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	46.37 ft				K_r = 1.03E-03 ft/sec 8.94E+01 ft/day 2.72E+01 m/day 3.15E-02 cm/sec					
9	nominal	Le =	61.40 ft									
10	% difference		24%									
11												
12												
13	Modulation Factor =		1.200				Unconfined - High-K Bouwer and Rice Model					
14												
15							$K_r = t_d^* r_c^2 \ln[R_e/r_w^*]$					
16	Dimensionless	C_D =		Adjusted			t*	2bC _D				
17	Time	0.9		Time								
18	0	1		0			$\ln(R_e/r_w^*) =$	2.808		A =	2.359	
19	0.1	0.995151		0.1200						B =	0.373	
20	0.2	0.98121		0.2400			first term	$1.1/(\ln((d+b)/r_w^*))$				
21	0.3	0.959093		0.3600				0.210				
22	0.4	0.929716		0.4800			second term			$(A + B * (\ln[(B - (d+b))/r_w^*])) / (b/r_w^*)$		
23	0.5	0.893983		0.6000						0.146		
24	0.6	0.852784		0.7200			$\ln[(B - (d+b))/r_w^*]$			4.152		
25	0.7	0.806982		0.8400						Cannot exceed 6.		
26	0.8	0.757411		0.9600						See Butler (1997) - p.108.		
27	0.9	0.70487		1.0800								
28	1	0.650115		1.2000			K_r = 8.84E-04 ft/sec 7.64E+01 ft/day 2.33E+01 m/day 2.70E-02 cm/sec					
29	1.1	0.593861		1.3200								
30	1.2	0.536775		1.4400								

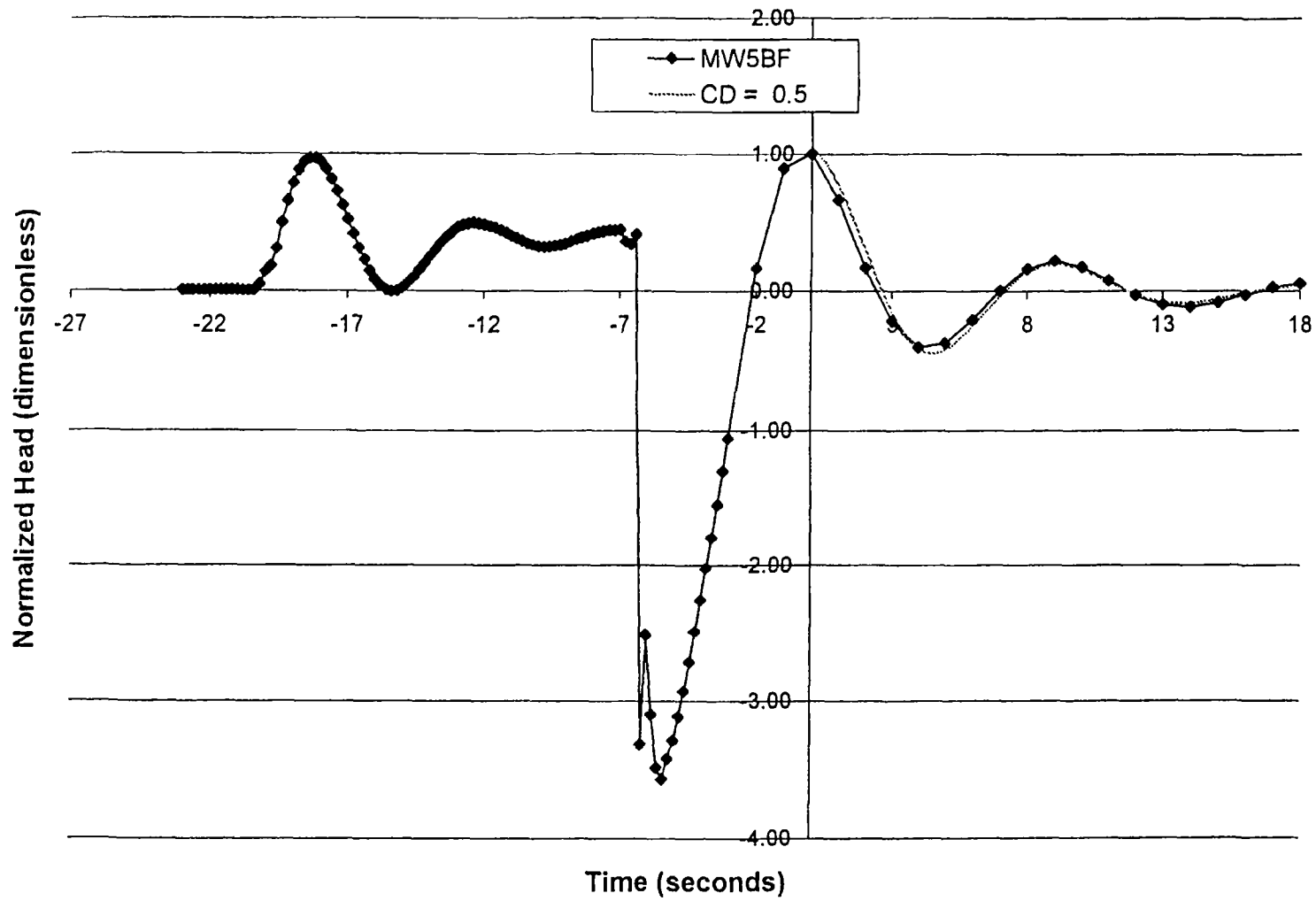
Curve Matching



MW-B5
Falling Head

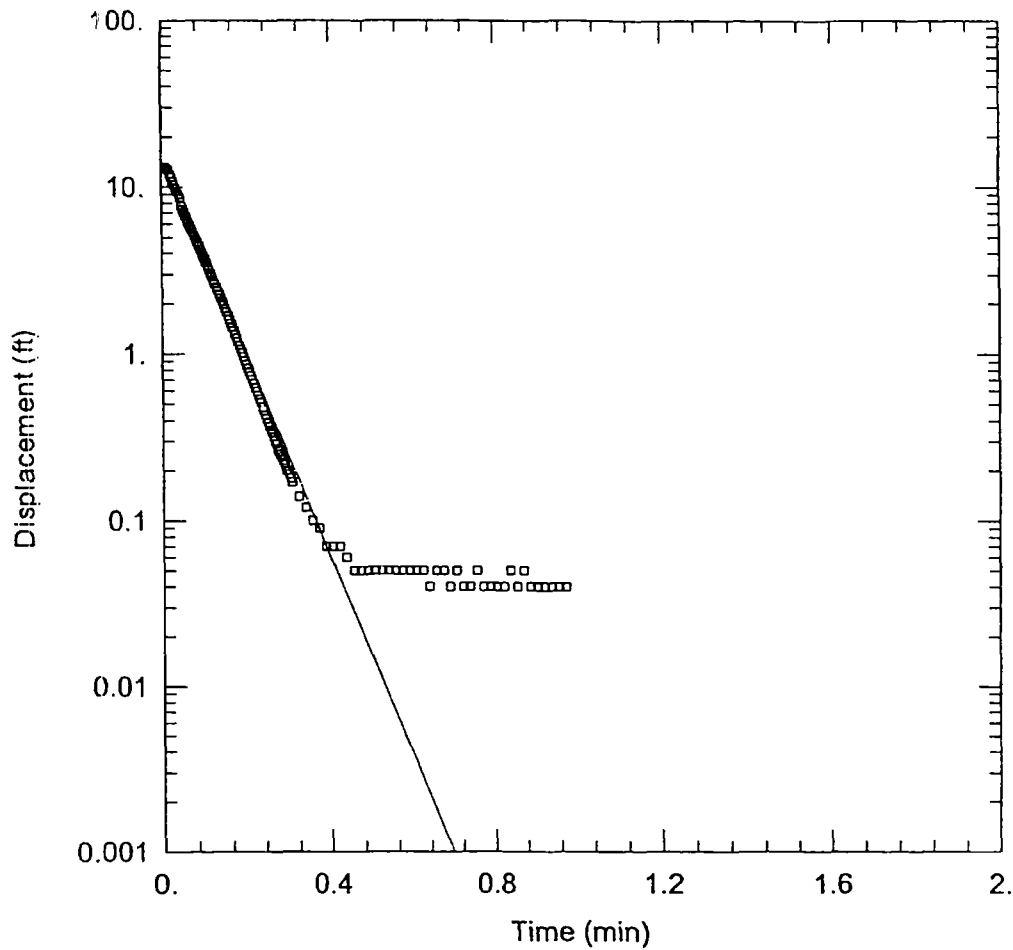
	L	M	N	O	P	Q	R	S	T	U	V	W
1												
2			Best Fit				Confined - High-K Hvorslev Model					
3	Time		Type Curve									
4	Correlation Ratio		C_D				$K_r =$	$t_d^* r_c^2 \ln[b/(2r_w^*) + (1 + (b/(2r_w^*))^2)^{0.5}]$				
5	t_d^*/t^*		0.5				t^*	$2bC_D$				
6	0.714											
7							Bracketted quantity				26.704	
8	computed from ratio	Le =	63.11 ft				<div style="border: 1px solid black; padding: 5px;"> $K_r =$ 1.60E-03 ft/sec 1.38E+02 ft/day 4.20E+01 m/day 4.86E-02 cm/sec </div>					
9	nominal	Le =	61.40 ft									
10	% difference		3%									
11												
12												
13	Modulation Factor =		1.400				Unconfined - High-K Bouwer and Rice Model					
14												
15							$K_r =$	$t_d^* r_c^2 \ln[R_e/r_w^*]$				
16	Dimensionless	$C_D =$		Adjusted			t^*	$2bC_D$				
17	Time	0.5		Time								
18	0	1		0			$\ln(R_e/r_w^*) =$	2.808		$A =$	2.359	
19	0.1	0.995086		0.1400						$B =$	0.373	
20	0.2	0.980714		0.2800				first term	$1.1/(\ln((d+b)/r_w^*))$			
21	0.3	0.957485		0.4200					0.210			
22	0.4	0.926057		0.5600				second term	$(A + B * (\ln[(B - (d+b))/r_w^*]))/(b/r_w^*)$			
23	0.5	0.887137		0.7000					0.146			
24	0.6	0.841468		0.8400				$\ln[(B - (d+b))/r_w^*]$	4.152			
25	0.7	0.789826		0.9800						Cannot exceed 6.		
26	0.8	0.733005		1.1200						See Butler (1997) - p.108.		
27	0.9	0.671812		1.2600								
28	1	0.607055		1.4000			$K_r =$	<div style="border: 1px solid black; padding: 5px;"> 1.36E-03 ft/sec 1.18E+02 ft/day 3.59E+01 m/day 4.17E-02 cm/sec </div>				
29	1.1	0.53954		1.5400								
30	1.2	0.47006		1.6800								

Curve Matching



ATTACHMENT B

AQTESOLV Plots



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB2R.AQT

Date: 06/26/02

Time: 20:01:25

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: MWB2R

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 13.12 ft

Water Column Height: 67.1 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 10. ft

Gravel Pack Porosity: 0.3

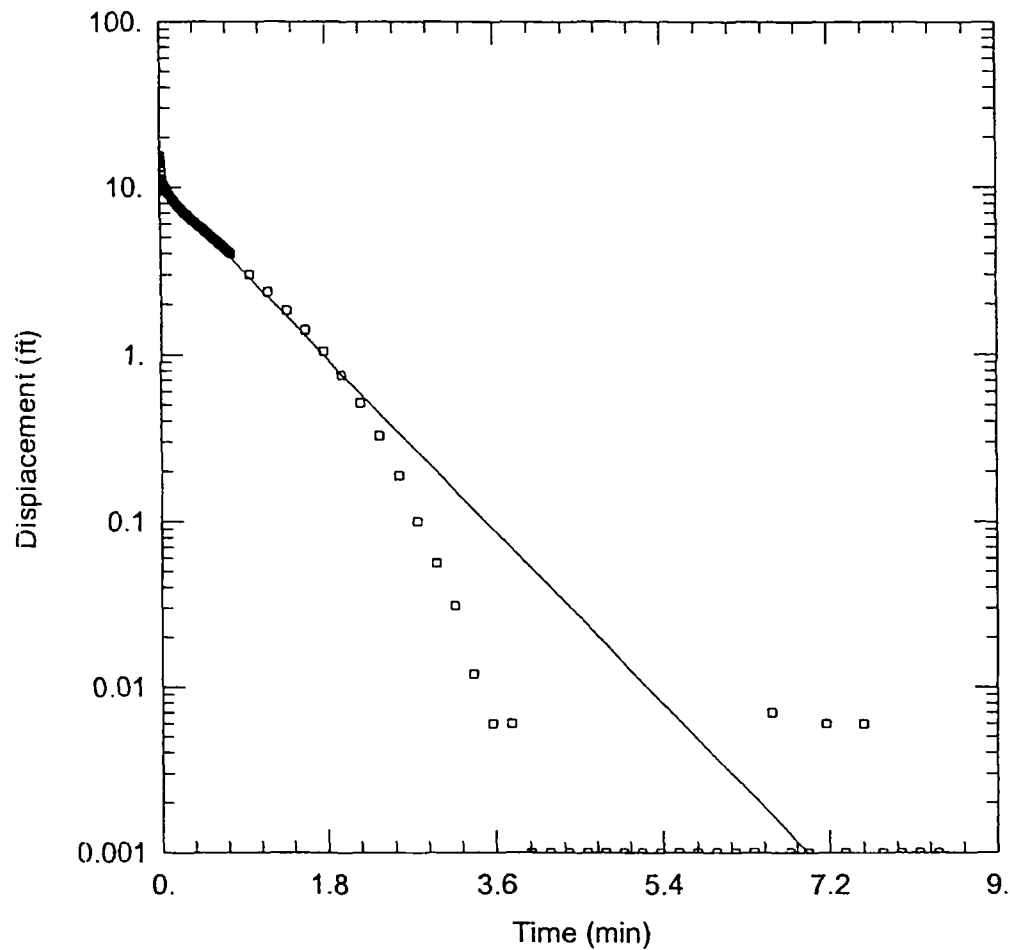
SOLUTION

Aquifer Model: Unconfined

$K = 181.8$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 14.92$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB2F.AQT

Date: 06/26/02

Time: 20:02:06

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: MWB2F

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 15.42 ft

Water Column Height: 67.1 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 10. ft

Gravel Pack Porosity: 0.3

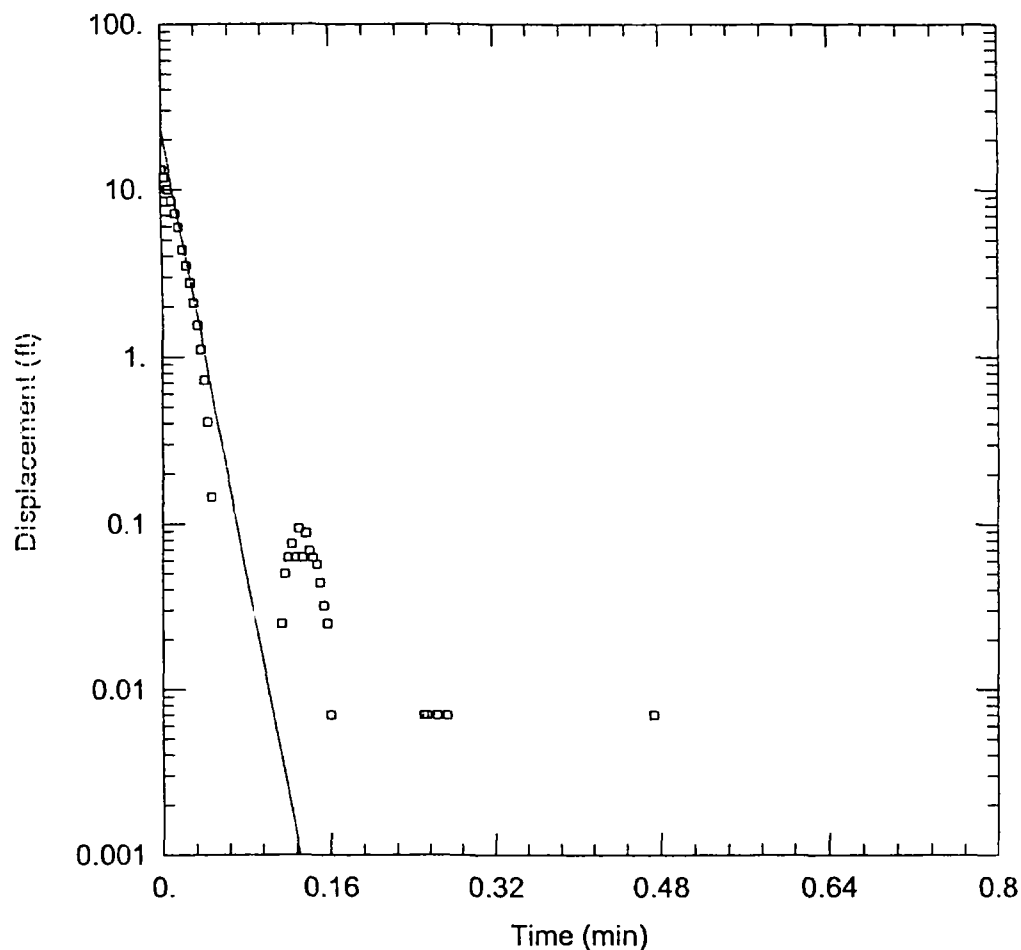
SOLUTION

Aquifer Model: Unconfined

$K = 17.47$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 10.38$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB3R.AQT

Date: 06/26/02

Time: 20:03:05

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: MWB3R

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 13.15 ft

Water Column Height: 35.73 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 10. ft

Gravel Pack Porosity: 0.3

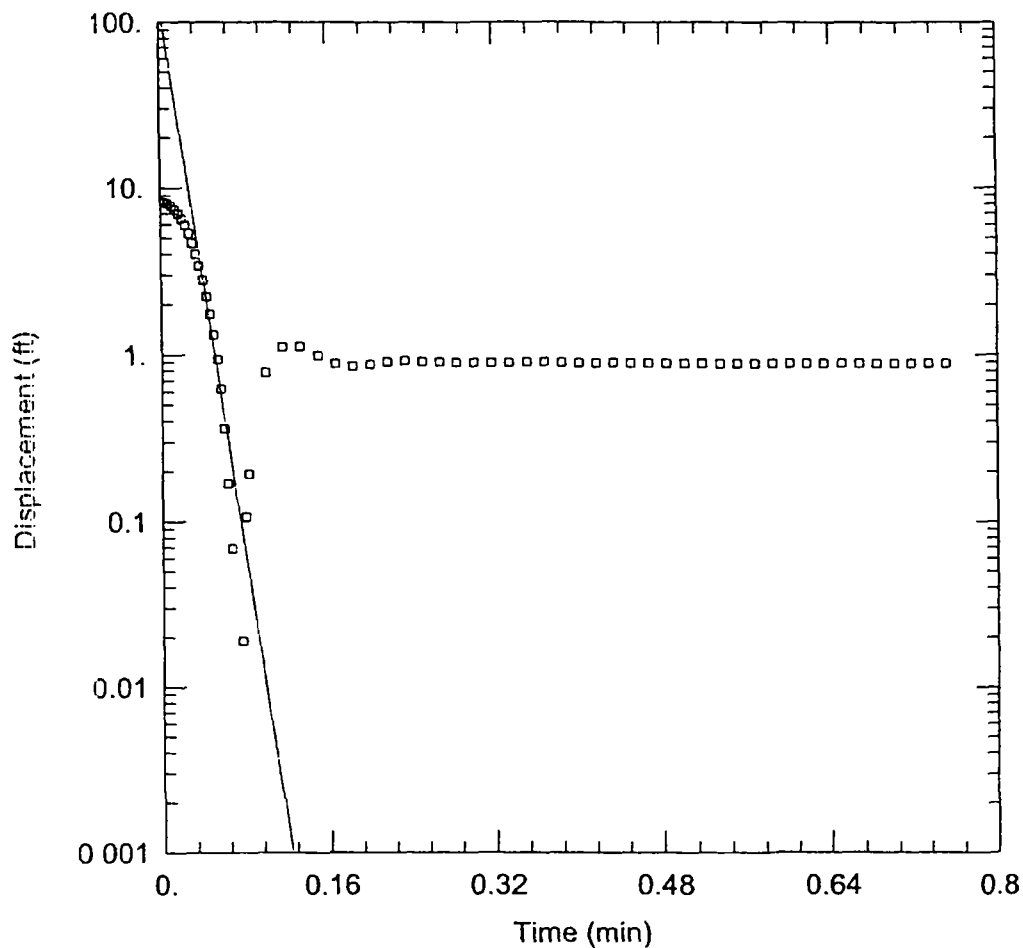
SOLUTION

Aquifer Model: Unconfined

$K = 908.7$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 23.71$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWB3F.AQT

Date: 06/26/02

Time: 20:02:47

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: MWB3F

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 8.283 ft

Water Column Height: 35.73 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 10. ft

Gravel Pack Porosity: 0.3

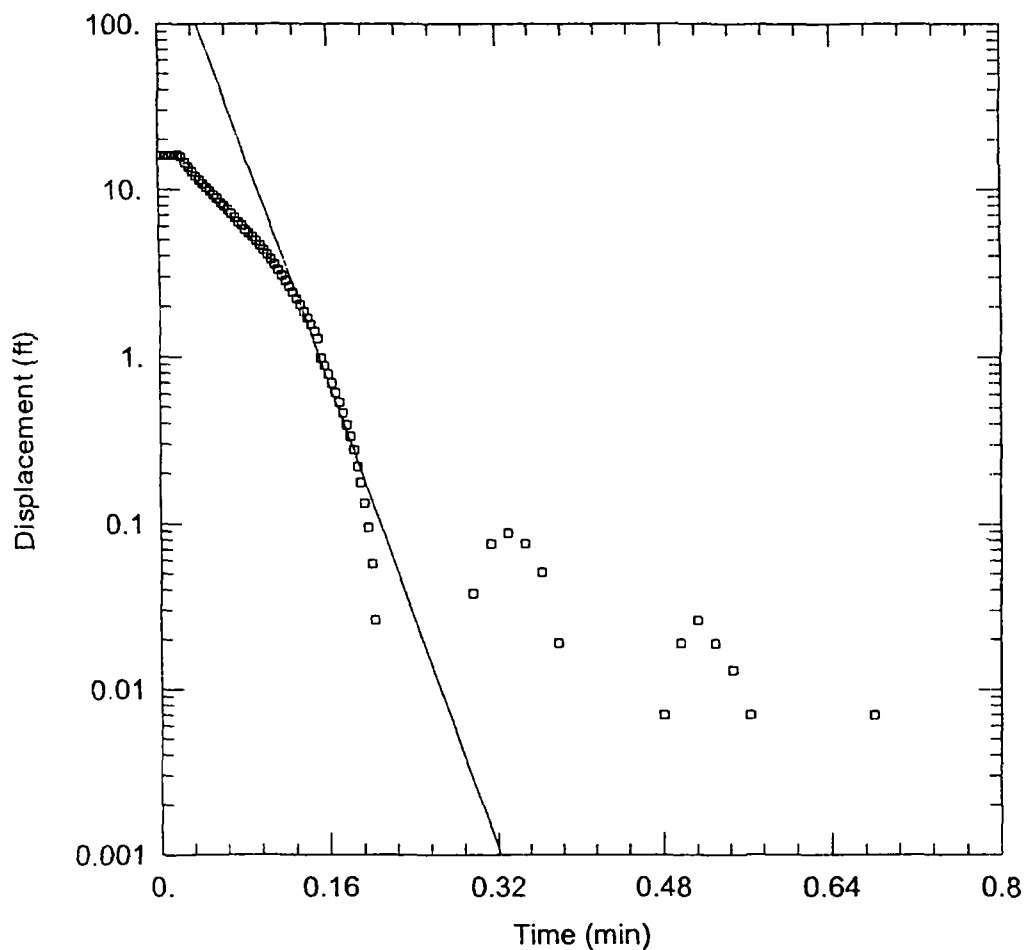
SOLUTION

Aquifer Model: Unconfined

$K = 1135.8$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 137.7$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWC1R.AQT

Date: 06/26/02

Time: 19:26:22

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: MWC1R

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 100. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 16.07 ft

Water Column Height: 95.07 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 10. ft

Gravel Pack Porosity: 0.3

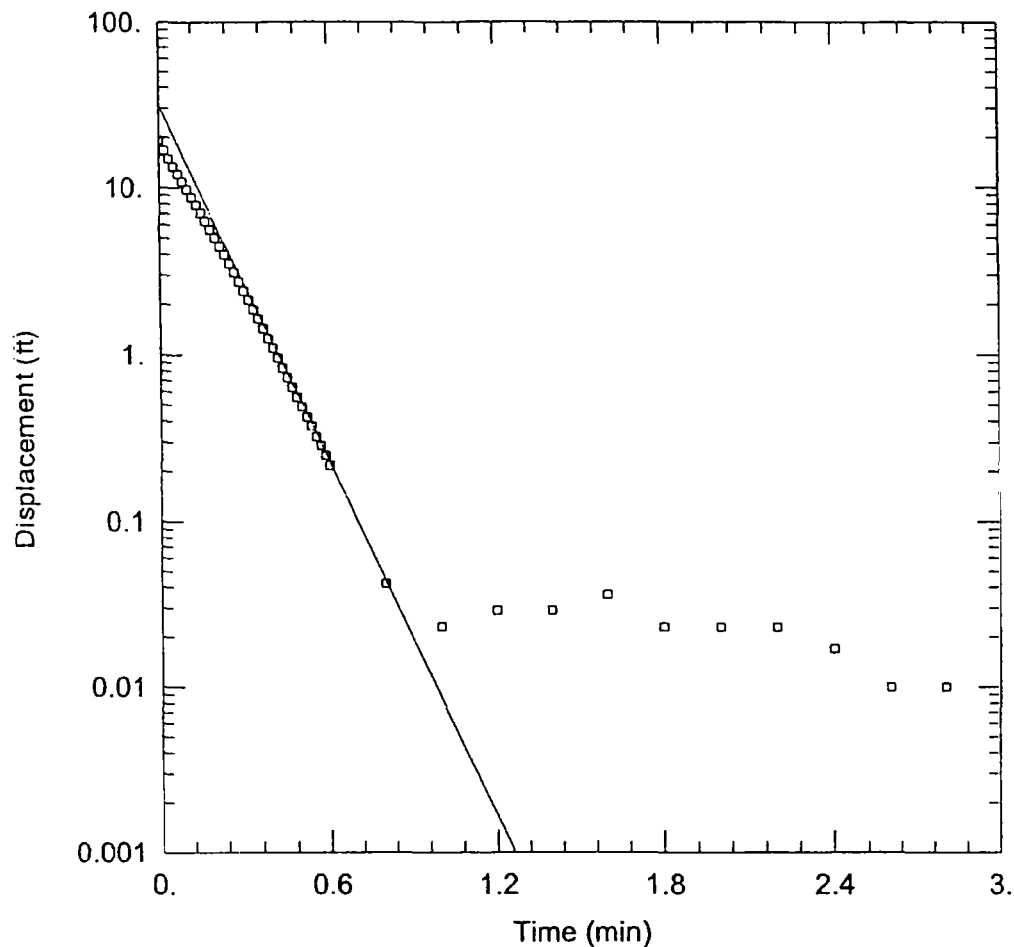
SOLUTION

Aquifer Model: Unconfined

$K = 569.2$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 468.$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD-1\SLUGTE-1\MWC2F.AQT
 Date: 06/26/02 Time: 19:26:53

PROJECT INFORMATION

Company: Earth Tech
 Client: Daimler Chrysler
 Test Well: MWC2F
 Test Date: 5/30/02

AQUIFER DATA

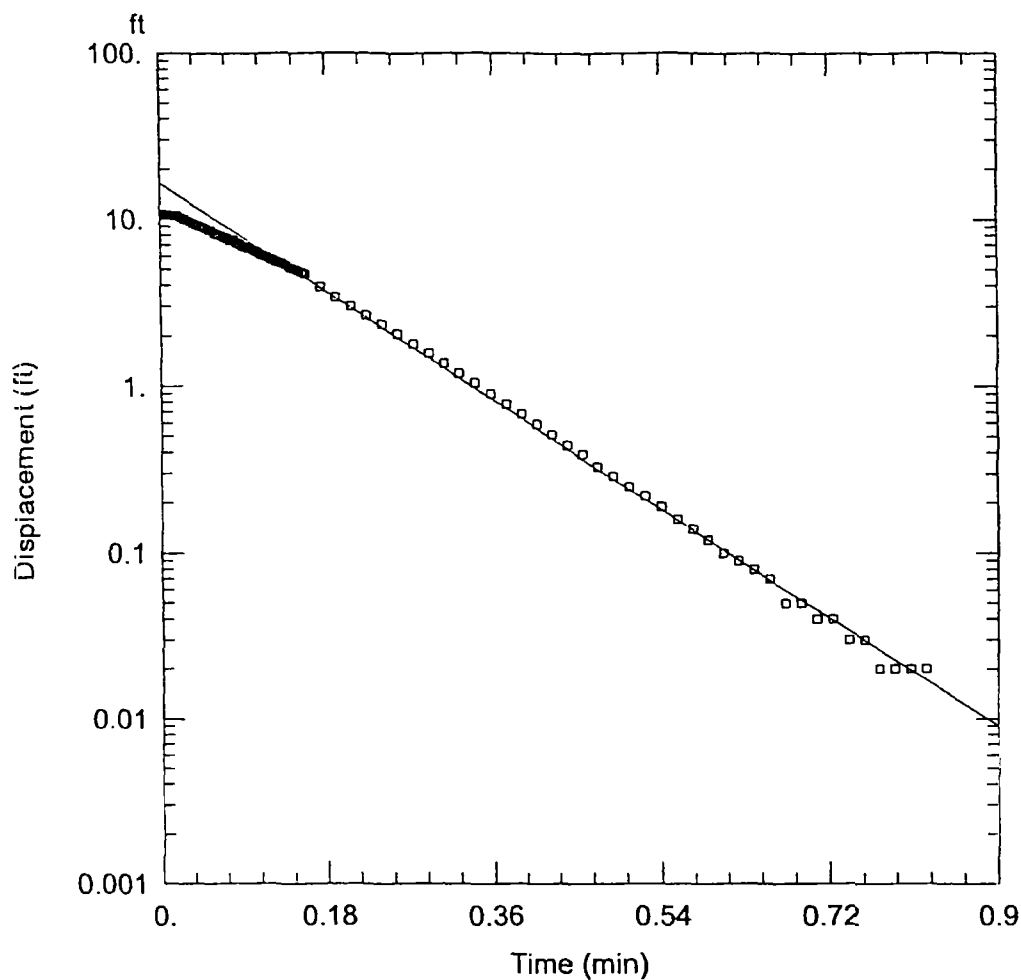
Saturated Thickness: 100. ft Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 19.17 ft Water Column Height: 89.65 ft
 Casing Radius: 0.08333 ft Wellbore Radius: 0.375 ft
 Screen Length: 10. ft Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined $K = 112. \text{ ft/day}$
 Solution Method: Bouwer-Rice $y_0 = 31.79 \text{ ft}$



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\MWC2R.AQT
 Date: 06/26/02 Time: 19:27:17

PROJECT INFORMATION

Company: Earth Tech
 Client: Daimler Chrysler
 Test Well: MWC2R
 Test Date: 5/30/02

AQUIFER DATA

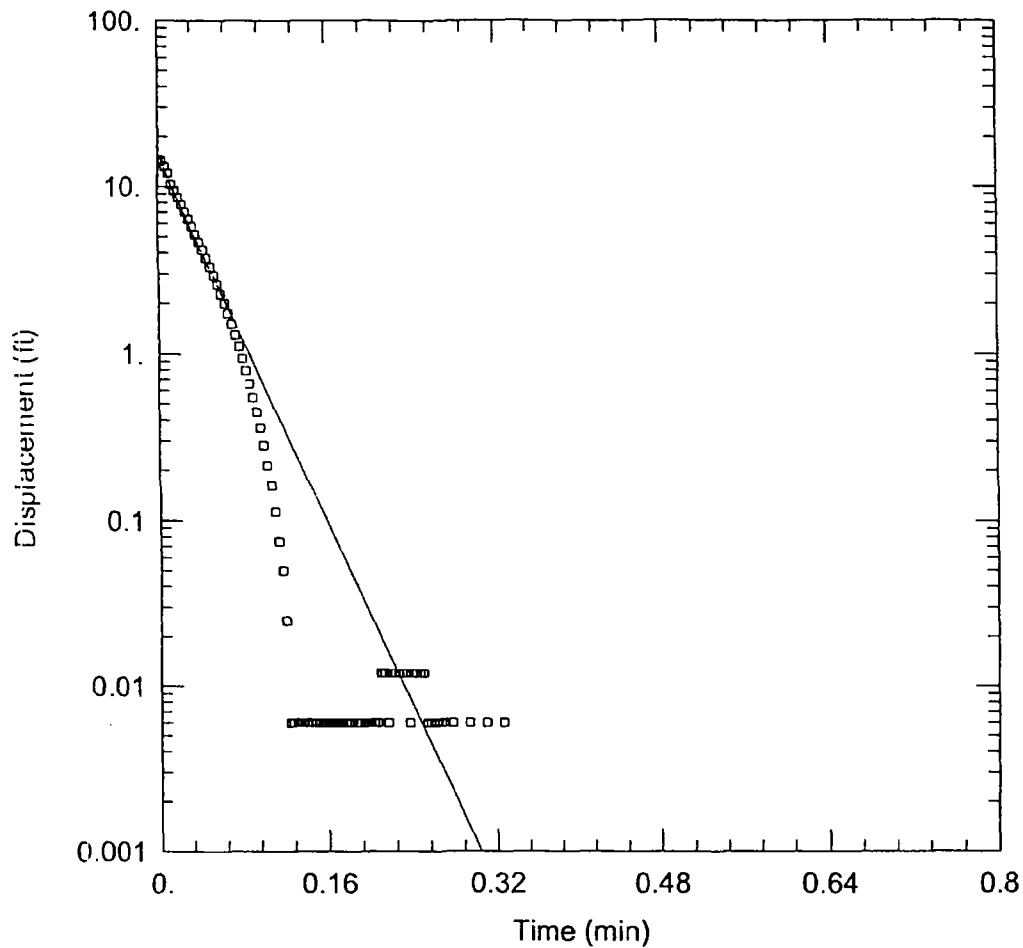
Saturated Thickness: 100 ft Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 10.75 ft Water Column Height: 89.65 ft
 Screen Length: 10. ft Gravel Pack Porosity: 0.3

Solution Method: Bouwer-Rice

SOLUT₀ = 16.6 ft/day



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ7IR.AQT

Date: 06/26/02

Time: 20:04:07

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: PZ7IR

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 14.53 ft

Water Column Height: 36.42 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 2. ft

Gravel Pack Porosity: 0.3

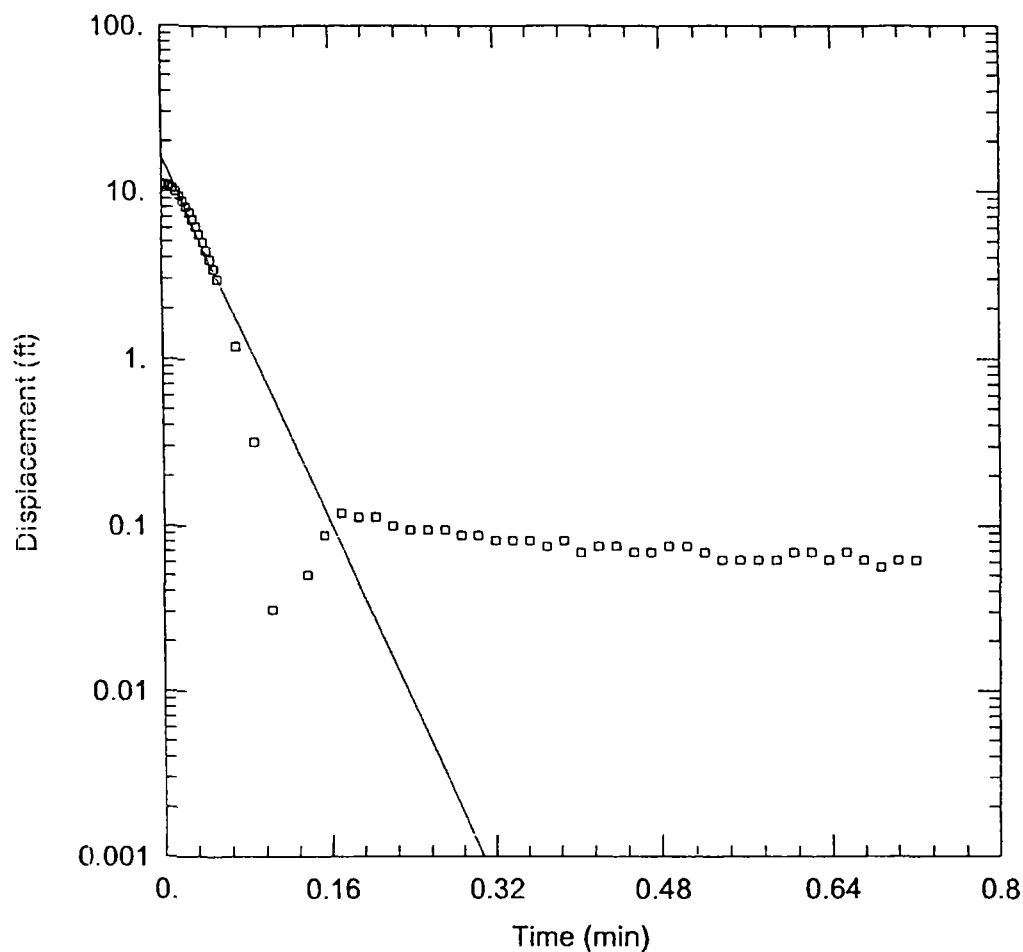
SOLUTION

Aquifer Model: Unconfined

$K = 1267.1$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 15.88$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ7IF.AQT

Date: 06/26/02

Time: 19:27:48

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: PZ7IF

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 11.06 ft

Water Column Height: 36.42 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 2. ft

Gravel Pack Porosity: 0.3

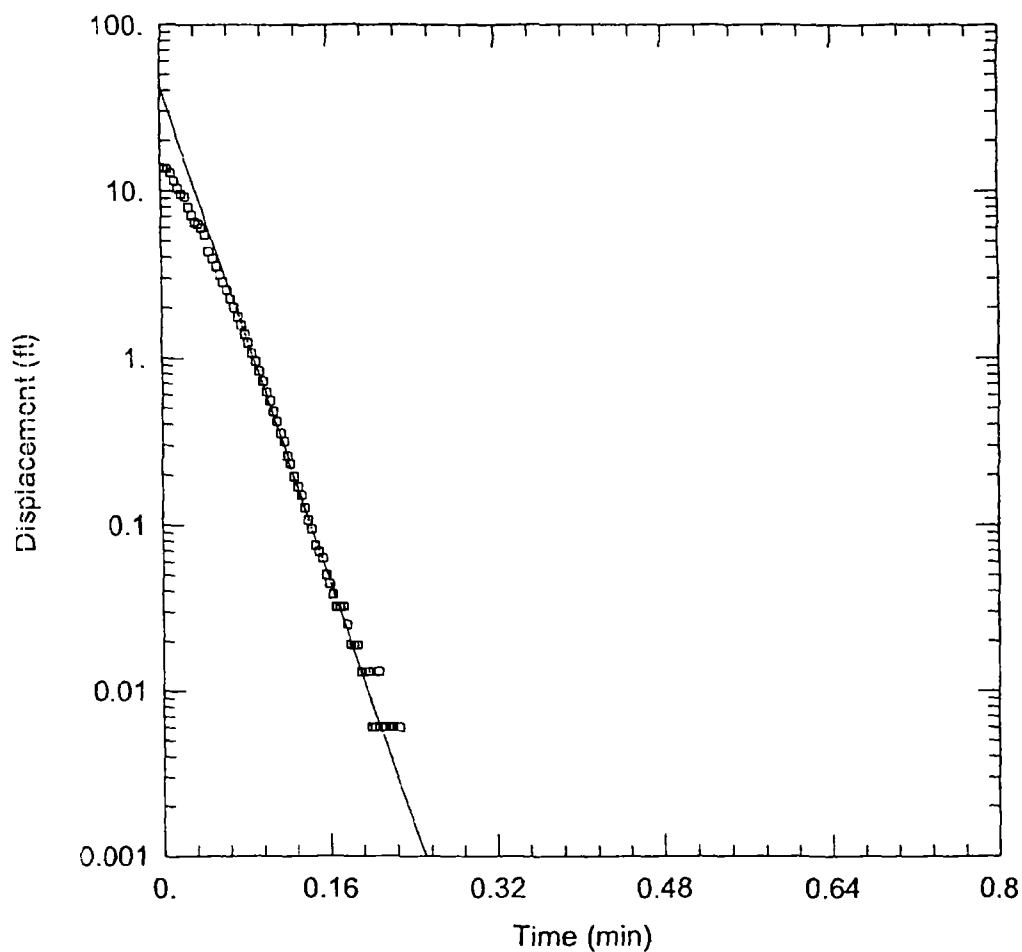
SOLUTION

Aquifer Model: Unconfined

K = 1254.9 ft/day

Solution Method: Bouwer-Rice

y0 = 16.19 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ8IR.AQT

Date: 06/26/02

Time: 20:04:38

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: PZ8IR

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Initial Displacement: 13.8 ft

Water Column Height: 19.31 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 2. ft

Gravel Pack Porosity: 0.3

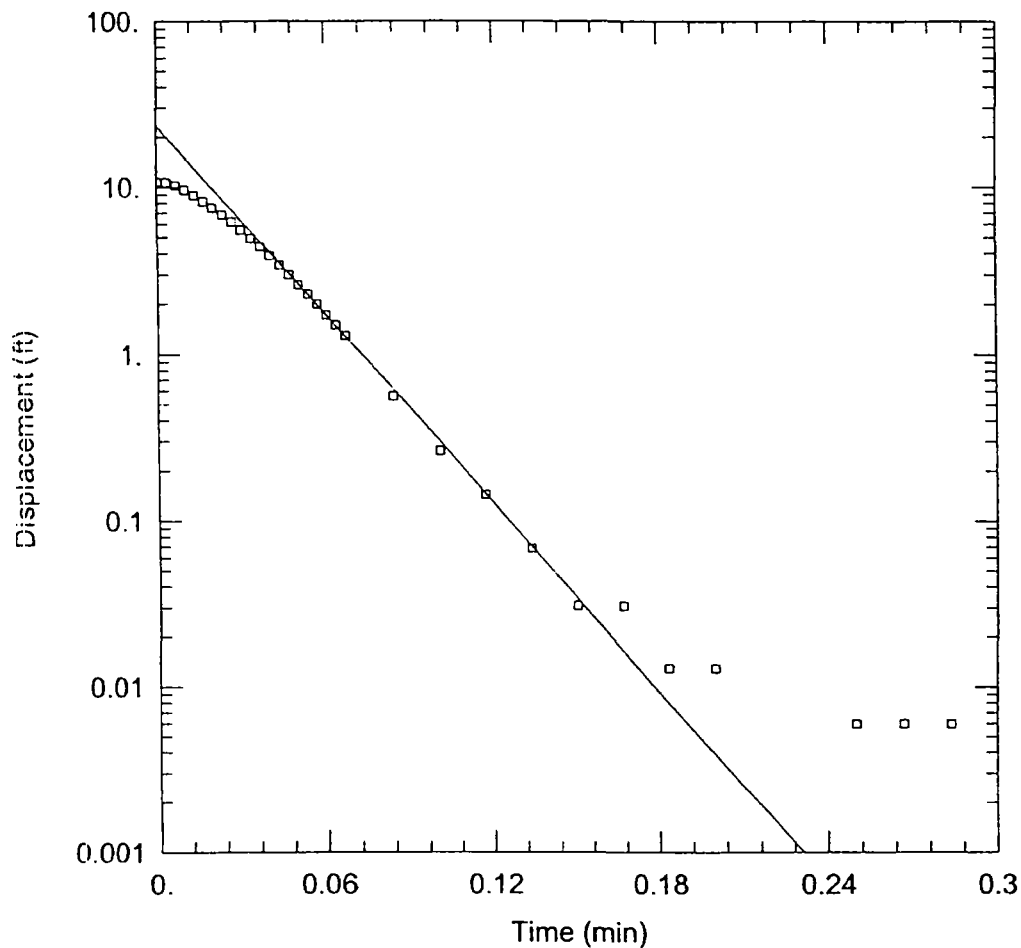
SOLUTION

Aquifer Model: Unconfined

K = 1601.8 ft/day

Solution Method: Bouwer-Rice

y0 = 43.08 ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ8IF.AQT

Date: 06/26/02

Time: 19:28:53

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: PZ8IF

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 10.72 ft

Water Column Height: 19.31 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 2. ft

Gravel Pack Porosity: 0.3

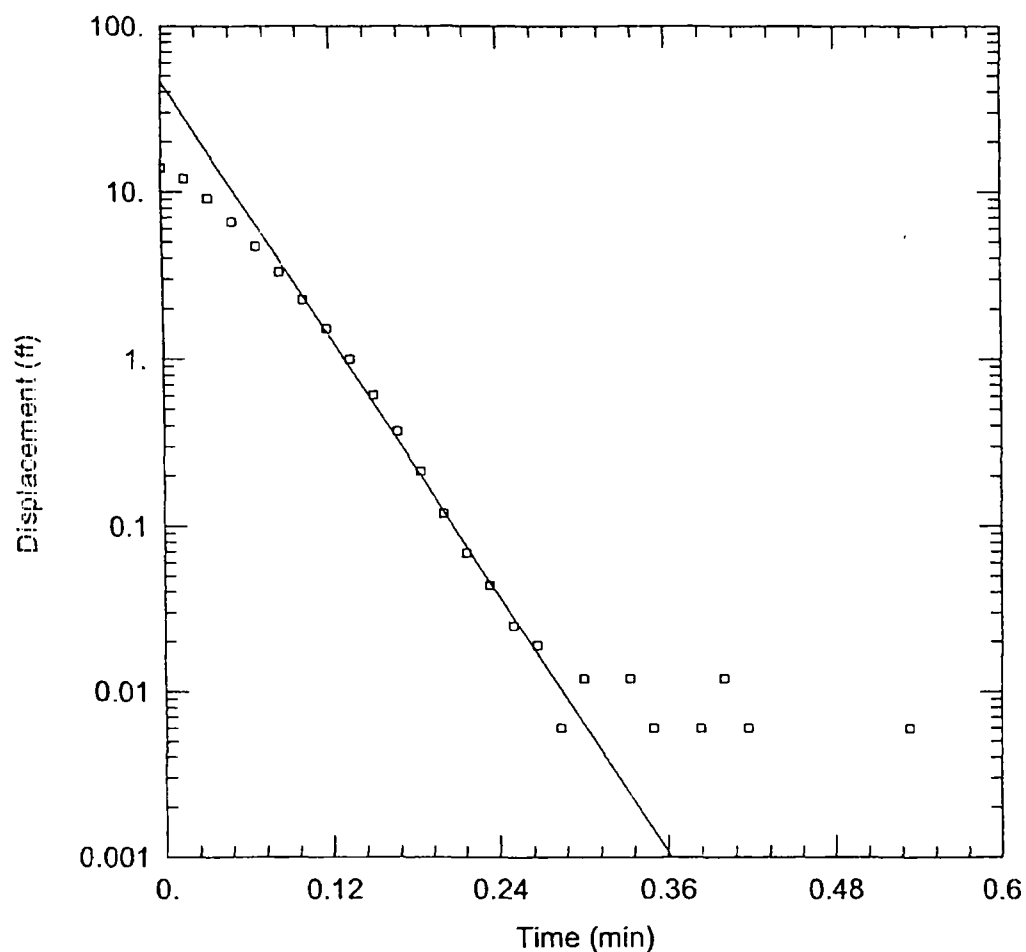
SOLUTION

Aquifer Model: Unconfined

$K = 1636.4$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 23.64$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ8DF.AQT

Date: 06/26/02

Time: 19:29:11

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: PZ8DF

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 80. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 13.93 ft

Water Column Height: 60.49 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 2. ft

Gravel Pack Porosity: 0.3

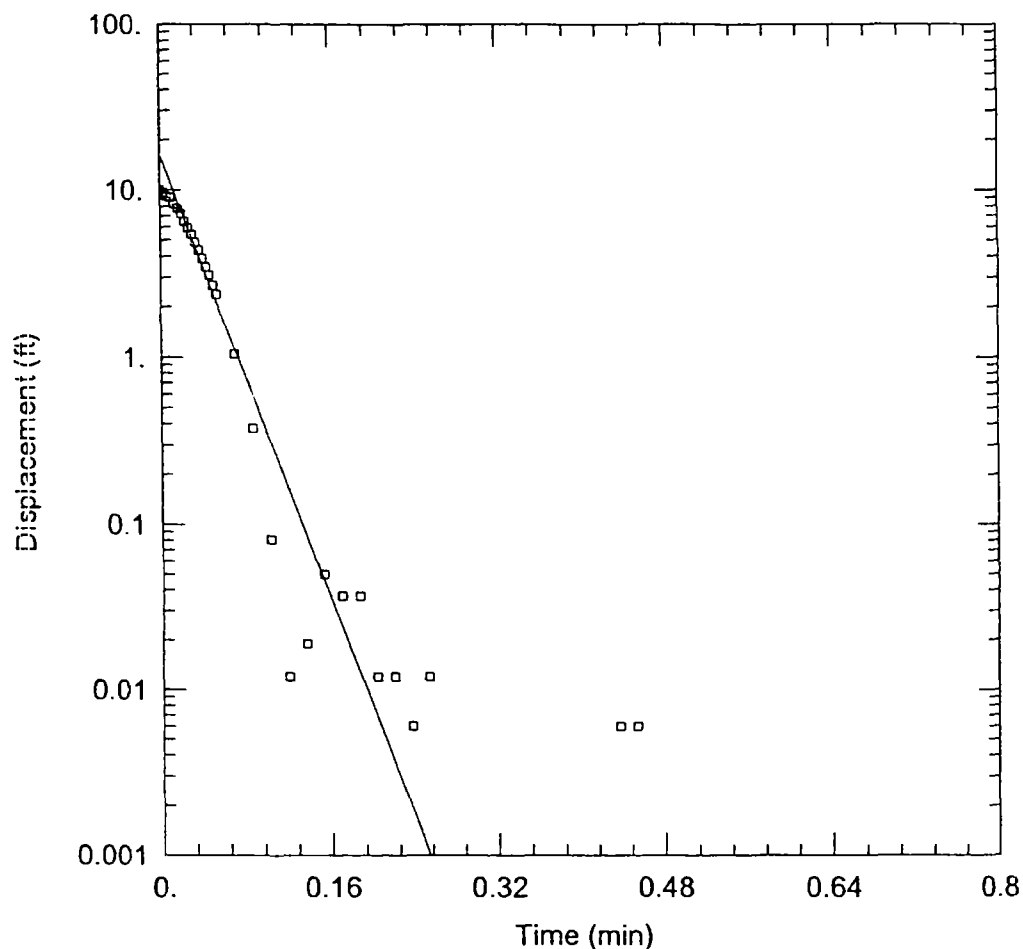
SOLUTION

Aquifer Model: Unconfined

$K = 1273.1$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 46.57$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD-1\SLUGTE-1\PZ16DF.AQT

Date: 06/26/02

Time: 19:30:21

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: PZ16DF

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 85 ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 10.04 ft

Water Column Height: 63.64 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 4 ft

Gravel Pack Porosity: 0.3

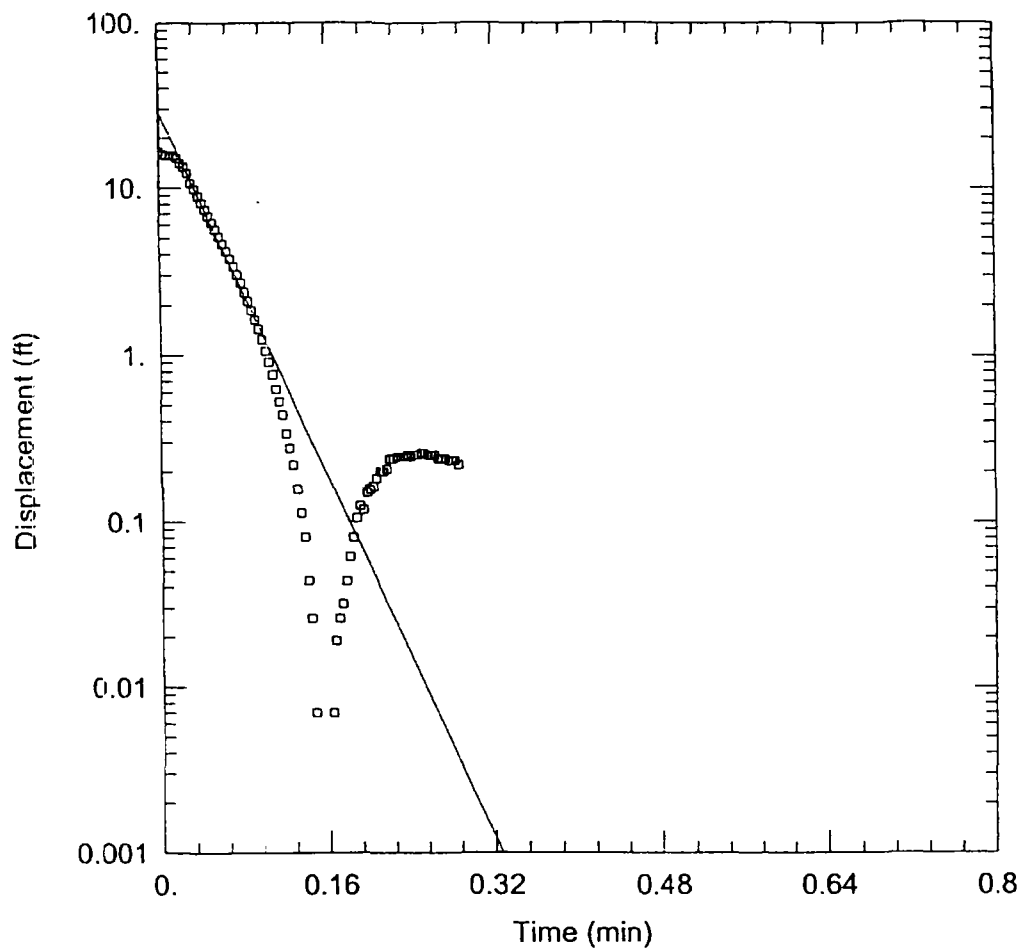
SOLUTION

Aquifer Model: Unconfined

$K = 1031.5$ ft/day

Solution Method: Bouwer-Rice

$y_0 = 16.68$ ft



WELL TEST ANALYSIS

Data Set: L:\WORK\55465\PROJAD~1\SLUGTE~1\PZ16DR.AQT

Date: 06/26/02

Time: 19:30:41

PROJECT INFORMATION

Company: Earth Tech

Client: Daimler Chrysler

Test Well: PZ16DR

Test Date: 5/30/02

AQUIFER DATA

Saturated Thickness: 85. ft

Anisotropy Ratio (K_z/K_r): 0.1

WELL DATA

Initial Displacement: 16.57 ft

Water Column Height: 63.64 ft

Casing Radius: 0.08333 ft

Wellbore Radius: 0.375 ft

Screen Length: 4. ft

Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined

$K = 844. \text{ ft/day}$

Solution Method: Bouwer-Rice

$y_0 = 28.65 \text{ ft}$

Appendix B - Geochemistry Technical Memorandum

MARCH 4, 2003

T E C H M E M O

Date: July 3, 2002

To: Rob Stenson, Earth Tech
Gary Stanczuk, DaimlerChrysler

From: Paul Barnes

Subject: **Assessment of the Potential for Enhancing
Natural Attenuation Processes
Dayton Thermal Products Facility
Dayton, Ohio**

Introduction

This technical memorandum is intended to assess the potential for applying enhanced natural attenuation principles to the treatment of groundwater contaminated by tetrachloroethylene (PCE) and trichloroethylene (TCE) at the Dayton Thermal Products facility. In general, TCE contamination at the site is widespread and varies greatly in concentration while the area of PCE concentration is smaller and always co-located with TCE contamination.

Natural attenuation of TCE contamination by either aerobic cometabolism or reductive dechlorination processes is possible at some sites. Since TCE itself is a poor substrate for microbial growth, aerobic cometabolism is generally possible only in the presence of an aerobically degradable substance that allows the growth of organisms that produce a group of enzymes called monooxygenases (MOs), that can begin the degradation process by cleaving the recalcitrant TCE molecule into smaller, more degradable products. These degradation products are many and generally non-persistent, so naturally occurring aerobic cometabolism is difficult to measure directly but this type of spontaneous aerobic cometabolism has been observed on sites where co-contamination with biodegradable compounds like light petroleum hydrocarbons exists.

Reductive dechlorination, the other potential process, must also be facilitated by the presence of another readily biodegradable substrate but reductive dechlorination occurs only under anaerobic and reducing conditions. This process produces a distinct pathway of sequential dechlorination through cis-1,2-dichloroethylene (cis-DCE), vinyl chloride, and ethene, intermediates that sometimes persist long enough to be measured as evidence of reductive dechlorination. Naturally occurring reductive dechlorination is possible in the presence of a significant input of biodegradable substrate combined with persistent reducing conditions.

Either process can be initiated and/or enhanced in most aquifers, depending upon geochemical and hydraulic conditions.

PCE is less amenable to biological treatment overall and aerobic cometabolism by indigenous organisms is not generally possible. PCE must typically be addressed by reductive dechlorination, at least to remove the first chlorine and produce TCE.

Data Evaluation

To determine if any natural attenuation is occurring or has the potential to be enhanced, evaluations of historical contaminant and water level data, and newly collected transformation product and geochemistry data were conducted. This evaluation consisted of reconstructing and correlating trends in contamination and water table elevation over time, as well as considering geochemical interactions and nutrient availability.

Geochemistry

With respect to overall geochemistry, the aquifer exhibits relatively low dissolved oxygen (<1.0 mg/L) in the most contaminated (shallow) zone, which lends itself to an anaerobic approach such as reductive dechlorination. Competing electron acceptors for reductive dechlorination in the forms of iron, manganese, nitrate, and sulfate are present but in relatively low concentrations, suggesting that contaminants could be addressed efficiently without using excess substrate. pH and alkalinity are also well within reasonable working ranges and the predominance of ferrous iron over ferric iron suggests that the overall redox is at least mildly reducing. In all, geochemical conditions are amenable to a reductive dechlorination approach. Additionally, the concentrations of other electron acceptors such as ferric iron, manganese, nitrate and sulfate are clearly lower in wells where some dechlorination is indicated, confirming that reducing conditions can be developed in the redox range necessary for the reductive dechlorination process to proceed.

Evidence of Existing Dechlorination Activity

In general, while evidence of partial reductive dechlorination is present at some locations, there is substantial heterogeneity in contaminant dynamics across the site. Conditions appear to range from no apparent evidence of attenuation to very significant production of cis-DCE, an indication of reductive dechlorination. Even in locations where the production of cis-DCE is obvious, however, there is little evidence of further dechlorination to vinyl chloride and ethene and the total contaminant mass is relatively unaffected. Fluctuations up to 6 feet in groundwater elevation further confound the evaluation of attenuation because there appears to be some correlation between groundwater elevation and contaminant concentration at many locations. Additionally, there is no substantial evidence of a potential electron donor for reductive dechlorination, though there is some history of petroleum LNAPL releases in some areas and some low concentrations of total organic carbon (TOC) were measurable, though neither could be specifically correlated to observed dechlorination.

To address the difficulties of interpretation, we have selected some individual wells for detailed and separate evaluation. All were selected from the group that was recently re-sampled and they appear to represent the range of site conditions fairly well.

In general, most of the shallow wells that contain PCE or TCE also exhibit some evidence of current or historical dechlorination activity. Specifically, MW008S, MW018S, MWA002, MWA005, MWA006, PZ-012I, and PZ-013I (from among the re-sampled set) showed significant concentrations of the TCE reductive dechlorination product cis-DCE. MWA002, MWA006 and PZ-012I are discussed individually below as examples.

Well ID

Summary of Results & Interpretation

MWA002

Depth: 40'

MWA002 (Figure 1) has historically had high PCE concentrations that may be positively correlated to water level. Moderate TCE concentrations may also have been correlated to water level until February of 2000, but have not rebounded from a concentration minimum (for the period considered) observed at that time. Relatively high cis-DCE concentrations were observed beginning in January 1998 and seem to be correlated to, but lagging PCE/TCE concentration change events. This significant reductive dechlorination may account for the continued decline of TCE concentrations despite increasing water levels and the corresponding increasing PCE concentration. Since 1 ug/L TCE should be dechlorinated to produce only 0.73 ug/L cis-DCE, the very high DCE concentrations observed in July and October of 1999, exceeding both the PCE and TCE concentrations, may indicate some significant dechlorination of PCE as well. This cannot be verified from the available data as groundwater elevation changes may also explain the decrease in PCE, however the PCE concentration in MWA002 has not fully rebounded to previous concentrations as groundwater elevations have returned to previous levels. MWA002 also provides some indication that the microbial population may be able to facilitate degradation beyond cis-DCE, although no vinyl chloride was observed. Peak cis-DCE concentrations did not persist, but the mechanism for its removal is unclear based upon the available data. Further evidence of biological reduction is given by concentrations of nitrate (.047(J) mg/L), and sulfate (35.3 mg/L) that are much lower than the apparent background concentrations which are probably between 2 and 6 mg/L for nitrate and between 80 and 150 mg/L for sulfate. Stimulation of reductive dechlorination in this area should be feasible, but nitrogen nutrient supplementation for bacteria stimulation may also be necessary.

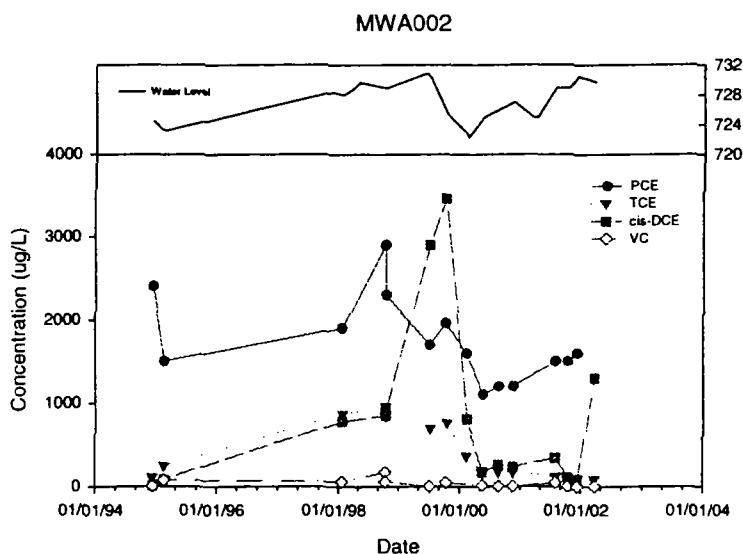


Figure 1: MWA002

Well ID

Summary of Results & Interpretation

MWA006

Depth: 40'

MWA006 (Figure 2) has historically shown TCE concentrations in the 1,500 to 2,000 ug/L range that may also be correlated with groundwater elevation. A groundwater elevation low around January of 2000 corresponded to a TCE concentration low, but also with the initiation of some apparent dechlorinating activity that has continued since then. This new level of activity has apparently produced a recent sharp decline in TCE concentration and a corresponding increase in cis-DCE. Nitrate and sulfate concentrations remain relatively high and may be facilitating the process without limitation at this stage, however significant concentrations of TCE and DCE are still present. Enhancement of reductive dechlorination in this area may be possible but would likely require some nitrogen supplementation. Also, it is not clear at this point why vinyl chloride has not been observed but it may be that the high concentrations of TCE favor the kinetics of the first dechlorination step over the subsequent ones.

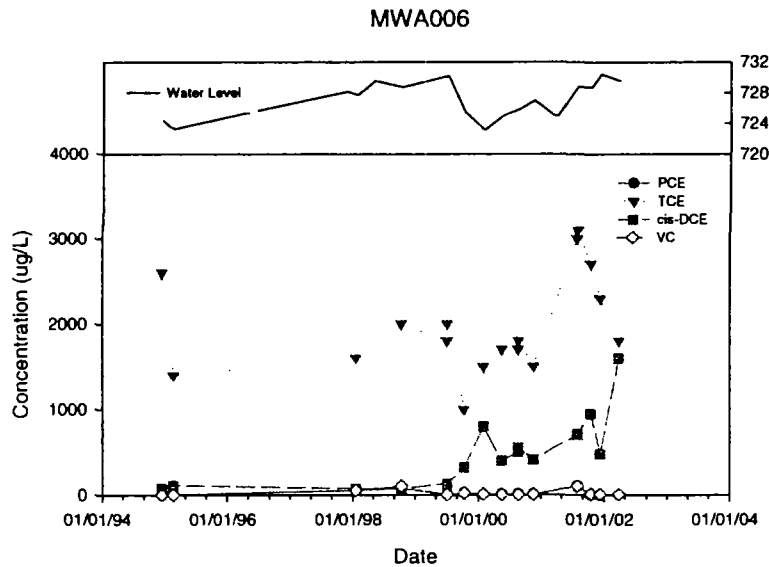


Figure 2: MWA006

Well ID Summary of Results & Interpretation

PZ012I
 Depth: 60'

PZ012I (Figure 3) is different from MWs 002 and 006 in that its contamination profile does not seem to be immediately correlated to groundwater elevation. This is interesting and suggests that the shallow groundwater may be periodically in contact with non-dissolved contaminants in the vadose zone or capillary fringe when water levels change, while deeper groundwater received contaminant input through diffusion from above. PZ012I has shown TCE concentrations as high as 2,000 ug/L, which appeared as a maximum in October 1998. Shortly after this maximum was observed the DCE concentration peaked at around 1,500 ug/L, falling back to and persisting at approximately 500 ug/L since then. After reaching its peak, the TCE concentration declined to levels around 100 ug/L and have persisted in that range. Since the peak TCE concentration does not seem to be associated with a particular hydrologic event it is unclear whether the peak TCE concentration in this area represents a real continuing source or a single release event, however it is clear that additional enhancement will be needed to reach MCLs in this area, as well as to remove the accumulated cis-DCE. Nitrogen has been depleted in this area and may be limiting the capacity for further dechlorinating activity.

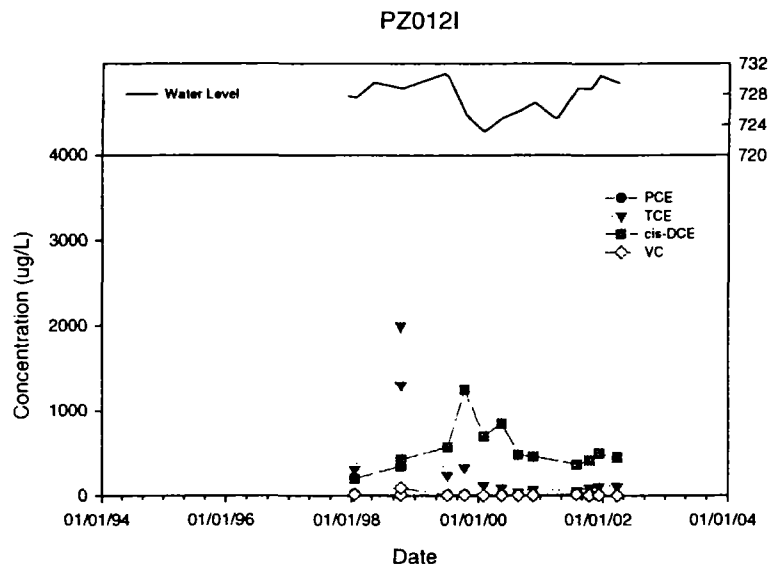


Figure 3: PZ012I

Two of the wells surveyed contained significant contamination but little or no evidence of dechlorination. PZ008I, near an apparently significant source area, and PZ037I, off-site and well separated from the primary release areas.

Well ID	Summary of Results & Interpretation
PZ008I Depth: 40'	Unlike the wells discussed above, there is very little evidence of dechlorination in PZ008I (Figure 4) despite very high concentrations of both PCE and TCE. Contaminant concentrations are not as well correlated to groundwater elevation in this area, possibly due to a much larger source of continuing contamination in the area. Nitrogen appears to be depleted here as well which may explain the lack of cis-DCE as the partial dechlorination of TCE does produce cis-DCE, but the partial dechlorination of PCE only produces more TCE. Any dechlorination potential expended on PCE in the area of PZ008I would therefore have contributed to the apparent TCE contamination and the concentrations are so high that the resulting increase in TCE concentration would likely be indistinguishable. Enhancement of reductive dechlorination in this area may be possible, but will require a large quantity of substrate and may require supplementation of nitrogen.

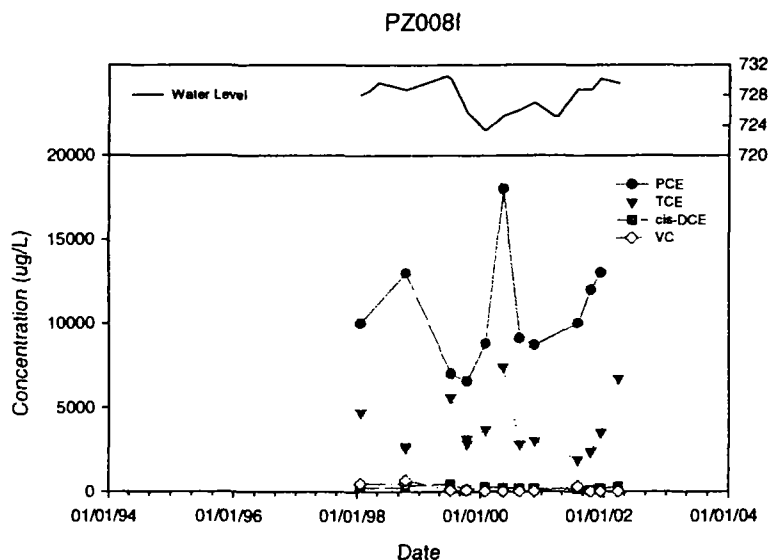


Figure 4: PZ008I

Well ID

Summary of Results & Interpretation

PZ037I No evidence of dechlorination is present in PZ037I despite TCE concentrations in the 4,000 ug/L range. Since little historical data from this location is available, no evaluation of trends can be made but, in the recent re-sample event, no available nitrogen was detected, which may suggest that nitrogen limitation prevents reductive dechlorination in that area.

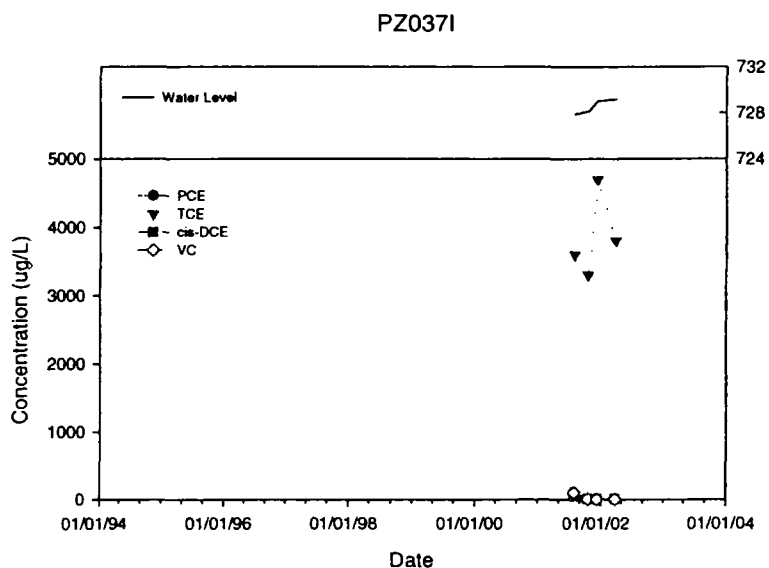


Figure 5: PZ037I

Technology Alternatives

The three primary classes of in-situ technology for remediation of groundwater contaminated by chlorinated solvents are enhanced bioremediation (subclasses discussed earlier), air sparging, and chemical oxidation. Air sparging will not be considered here as the infrastructure requirements and site logistical issues make it an undesirable option if others are available.

Chemical oxidation, consisting of the injection of a strong oxidant such as potassium permanganate, Fenton's reagent (hydrogen peroxide and ferrous iron), or ozone has been shown to be effective on chlorinated solvent contamination at some sites. The quantity of groundwater to be treated suggests that ozone treatment would be cost-prohibitive in this case and site geochemistry is less favorable for permanganate and Fenton's oxidation than might be the case at other sites. Both oxidants are most effective at low pH, as low as 4.0 to 4.5 for Fenton's reagent, which would require a substantial pH adjustment from the 6.0 to 7.8 range measured by Earth Tech. The pH adjustment would be complicated by a high natural buffer capacity. The aquifer's high alkalinity would also consume a substantial amount of any oxidant introduced, as would the naturally occurring organic matter. Other mitigating factors at this site might include the ability to deliver oxidant effectively directly to areas beneath structures and the safe handling of the large quantity of oxidant that would be needed.

In addition to these issues, Earth Tech believes chemical oxidation to be less appealing than reductive dechlorination because PCE and TCE are fundamentally recalcitrant under aerobic and mildly oxidizing conditions (without cometabolic enhancement). This suggests that any failure to completely remove contaminants by chemical oxidation would only leave the residuals in an environment that has already been shown to allow them to persist. The only solution in this case would be repeated attempts at oxidation until success is achieved which is complicated by access limitations. Alternatively, the reductive dechlorination method may also support downgradient cometabolism under aerobic conditions, and it produces degradation products that are known to be aerobically degradable. So, only the first-step dechlorination of the PCE component is required to eliminate the recalcitrant properties of the system. Once this is accomplished, even if reducing conditions were disrupted, there would still remain a possibility of degrading the remaining contaminants by another mechanism such as aerobic cometabolism (TCE) and simple aerobic heterotrophic degradation (vinyl chloride, ethene, ethane) which might be possible without any additional manipulation.

Because some difficulty in affecting in situ treatment can be expected at this type of site and because there is evidence of some naturally occurring capacity for reductive dechlorination, Earth Tech proposes the reductive dechlorination approach as a more cost-effective and logistically manageable alternative. Additionally, the reductive dechlorination technology can easily be combined with the hydraulic control system for delivery of enhancements in-situ, offering an alternative to a technology such as chemical oxidation that requires a more widespread and intrusive application of reagents.

Conclusions

The available data suggests that both groundwater geochemistry and the native microbial population are suitable for at least some reductive dechlorination to occur with additional enhancement. Potential limitations seem to include a lack of available nitrogen and, possibly, a reluctance to move beyond cis-DCE. Supplementing inorganic nitrogen along with the addition of reductive dechlorination substrate can easily address nitrogen limitation and would not be excessively costly. Facilitating dechlorination beyond cis-DCE should also be possible, if more difficult, because cases of genuine limitation in this area are rare. It is more likely that the limited pool of available nitrogen, combined with limited available carbon substrate and the relatively high contaminant concentrations result in a stoichiometric limitation that halts

microbial growth before the subsequent dechlorination steps can occur extensively enough to be measured.

Given all of this, Earth Tech would tentatively propose a reductive dechlorination approach for this site, contingent upon some additional pre-design testing to verify the microbial capacity of the system to complete the dechlorination process, as well as to evaluate the extent of nutritional stress imposed by the apparent lack of available nitrogen. Specific recommendations for additional work are described in the next section.

In general, the proposed approach would fit well with any hydraulic containment approach that may be necessary to halt or reverse contaminant migration, especially if such a system includes re-injection. Implementation in a recovery and re-injection configuration would allow substantial optimization of the process for type and quantity of substrate used, supplementation of other nutrients, or even re-distribution of microbial populations from areas of good activity to areas requiring more enhancement.

Recommendations for Additional Testing and Conceptual Approach

In order to address the potential limitations identified above, Earth Tech proposes a combination of microbiological assessment and simple microcosm studies that can be performed concurrently with the implementation of the hydraulic control system. Microbiological assessment would include phospholipid-fatty acid (PLFA) and DNA analysis to determine levels of microbial biomass and community structure with specific screening for known dechlorinating organisms. Microcosm studies would include only very simple stimulation studies to verify that stimulation and/or nitrogen supplementation do, in fact, produce the desired changes in microbial activity under these geochemical conditions. Specific attention would also be paid to verifying, at least qualitatively, further dechlorination or degradation of cis-DCE to vinyl chloride to ethene. These combined efforts would be intended to provide confirmation of gross feasibility and some suggestion of initial design parameters for implementation of a phased remediation program.

Microbiological Assessment

Earth Tech proposes to take samples from six locations representative of the variety of conditions observed. The proposed locations are MWA002, MWA005, MWA006, PZ008I, PZ037I, and MW020S. PLFA analyses will be used to evaluate and compare the microbial community structures in the areas sampled to determine what range of microbiological conditions is occurring without enhancement. The same data will also be used during treatment to evaluate changes affected by any purposeful enhancement. DNA analyses will also be used to identify and enumerate organisms that are known or likely to be capable of reductive dechlorination both before and during treatment and used, in combination with the results from bench scale pilots, to optimize enhancement for those types of organisms.

Microcosm Treatability

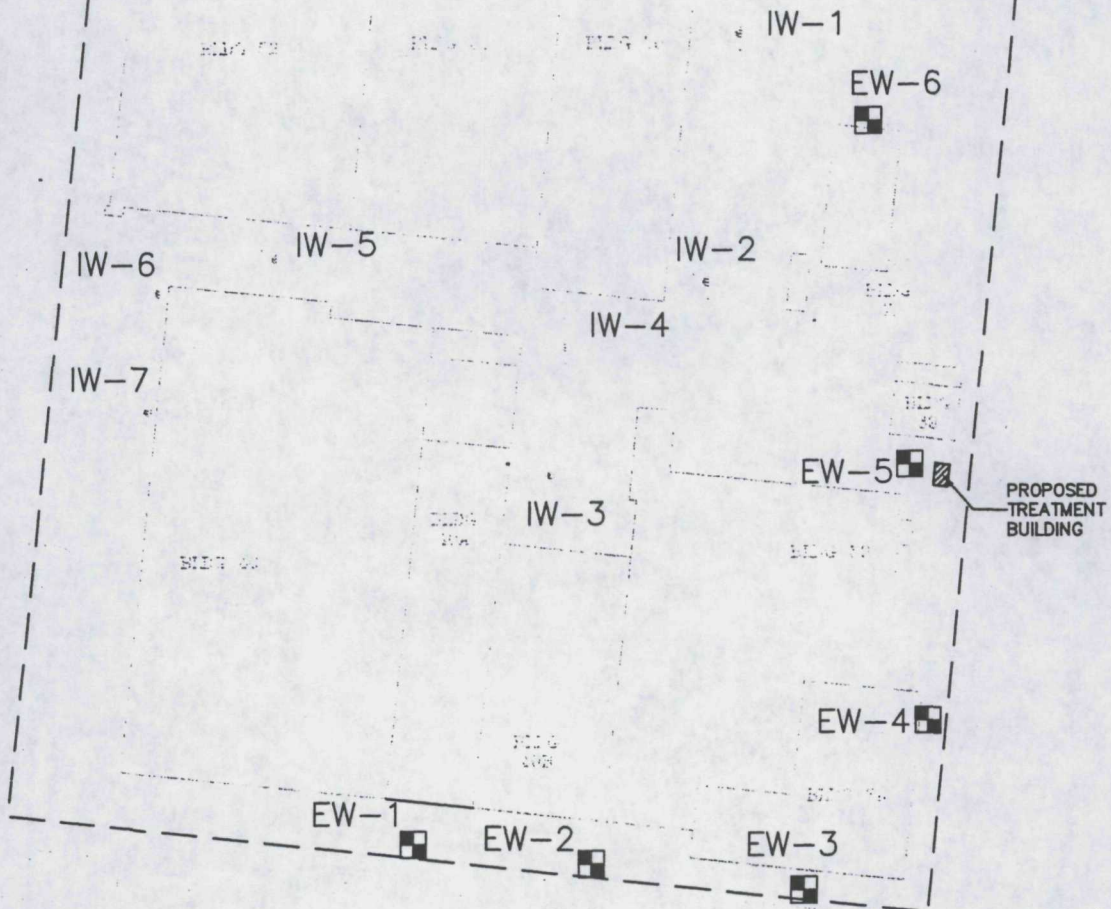
Microcosm studies are proposed to satisfy some simple pre-design objectives while hydraulic control is being established at the site. The studies proposed will be simple and focused very specifically on the following issues.

1. Verify and quantify enhancement of the anaerobic biological system in the context of site-specific geochemistry.

2. Evaluate nutritional stress due to the apparent lack of nitrogen, verify that nitrogen supplementation is effective.
3. Verify the system's capacity to complete the dechlorination process.

Studies will be conducted either as static or limited-recirculation microcosms designed to simulate in-situ geochemistry by combining both solid and liquid media from the site. The specific configuration of the physical apparatus will depend upon the properties of the combined media but, in general, will consist of triplicate bioreactors for each condition tested. Each microcosm will be constructed and maintained identically throughout the study (estimated at 60 days), with the exception of the amendment scenario being tested. Measurements of pH and Oxidation Reduction Potential (ORP) would indicate the development of reducing conditions and the time for direct sampling for contaminants and microbiological characterization. At the completion of the study, comparisons of the extents of treatment and/or impacts on the microbial populations under different amendment scenarios would be used to develop baseline design values for in-situ treatment as well as control limits for process monitoring and, possibly a predictive model for treatment.

PROPERTY BOUNDARY



LEGEND

- - PROPOSED INJECTION WELLS
- - PROPOSED EXTRACTION WELLS

E A R T H T E C H

A tycoo INTERNATIONAL LTD. COMPANY
4130 TECHNOLOGY PARKWAY, SHEBOYGAN, WISCONSIN 53083

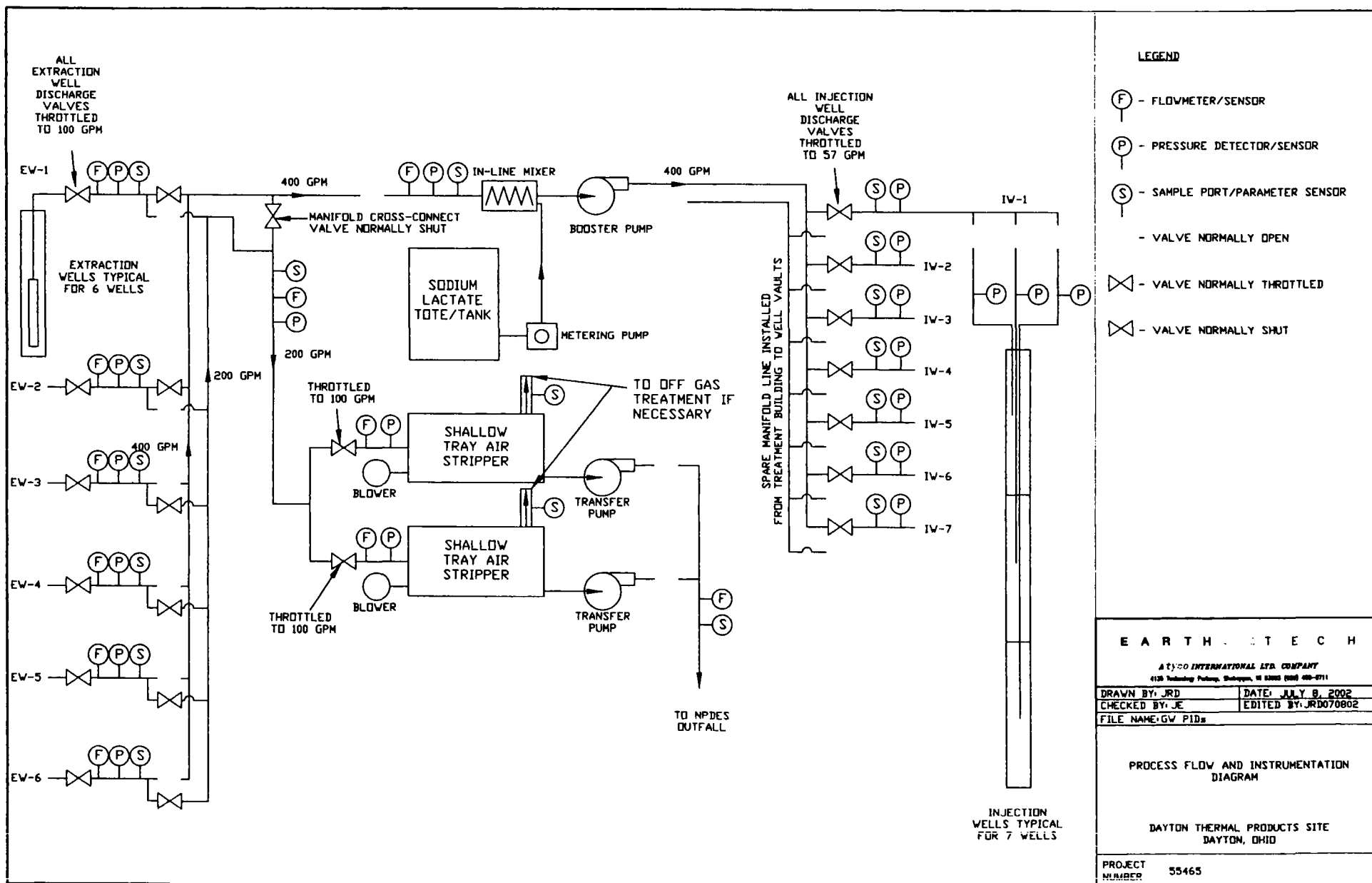
WELL LOCATIONS
DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

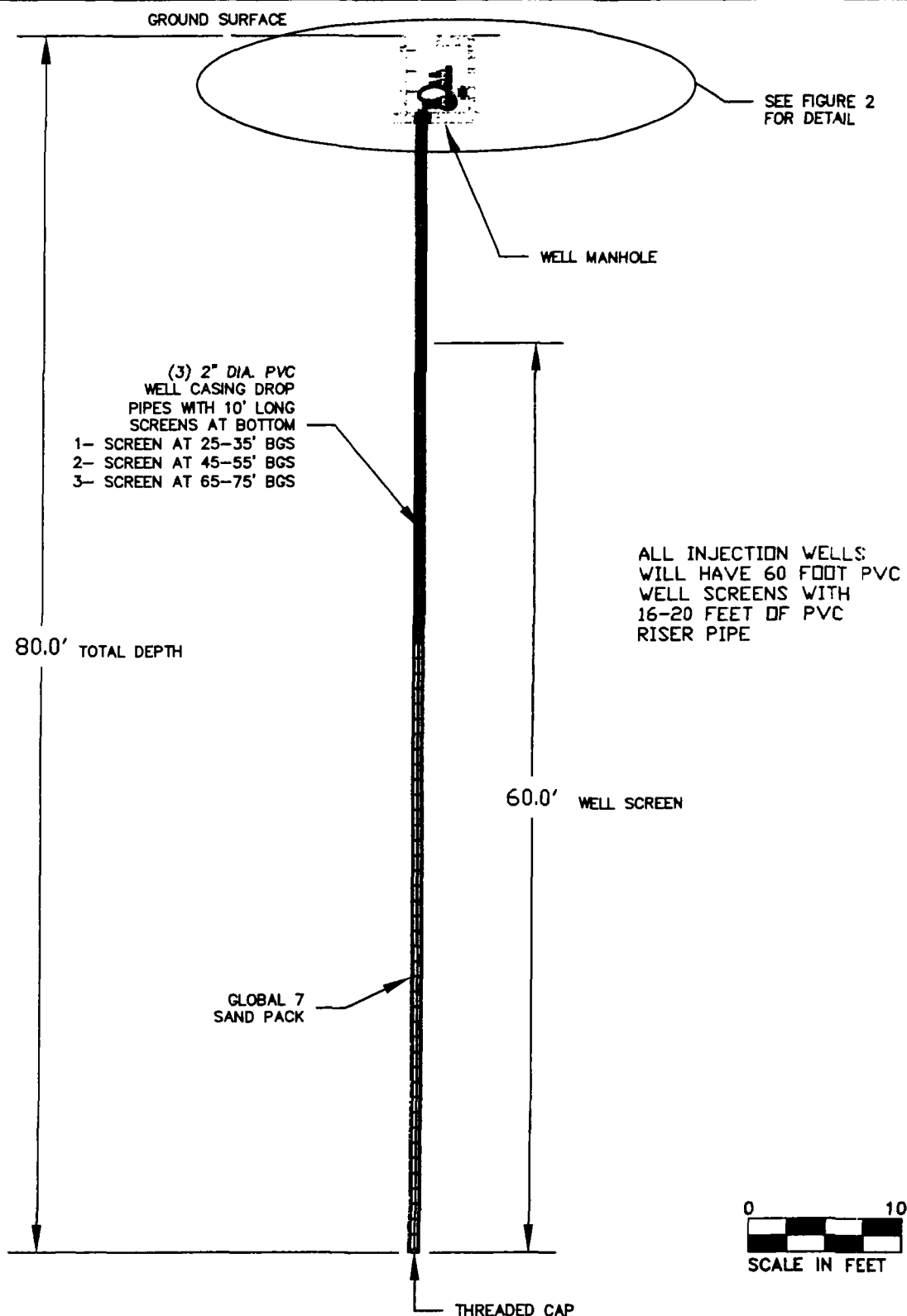
DRAWN BY: JRD
CHECKED BY: JE

EDITED BY: JRD
DATE: MARCH 4, 2003

PROJECT NUMBER: 55465
SCALE: 1/250

FILE NAME:
WELLS.DWG





EARTH TECH

Attyco INTERNATIONAL LTD. COMPANY

4135 Technology Parkway, Sheboygan, WI 53083 (920) 458-5711

DRAWN BY: JRD DATE: FEB. 5, 2003

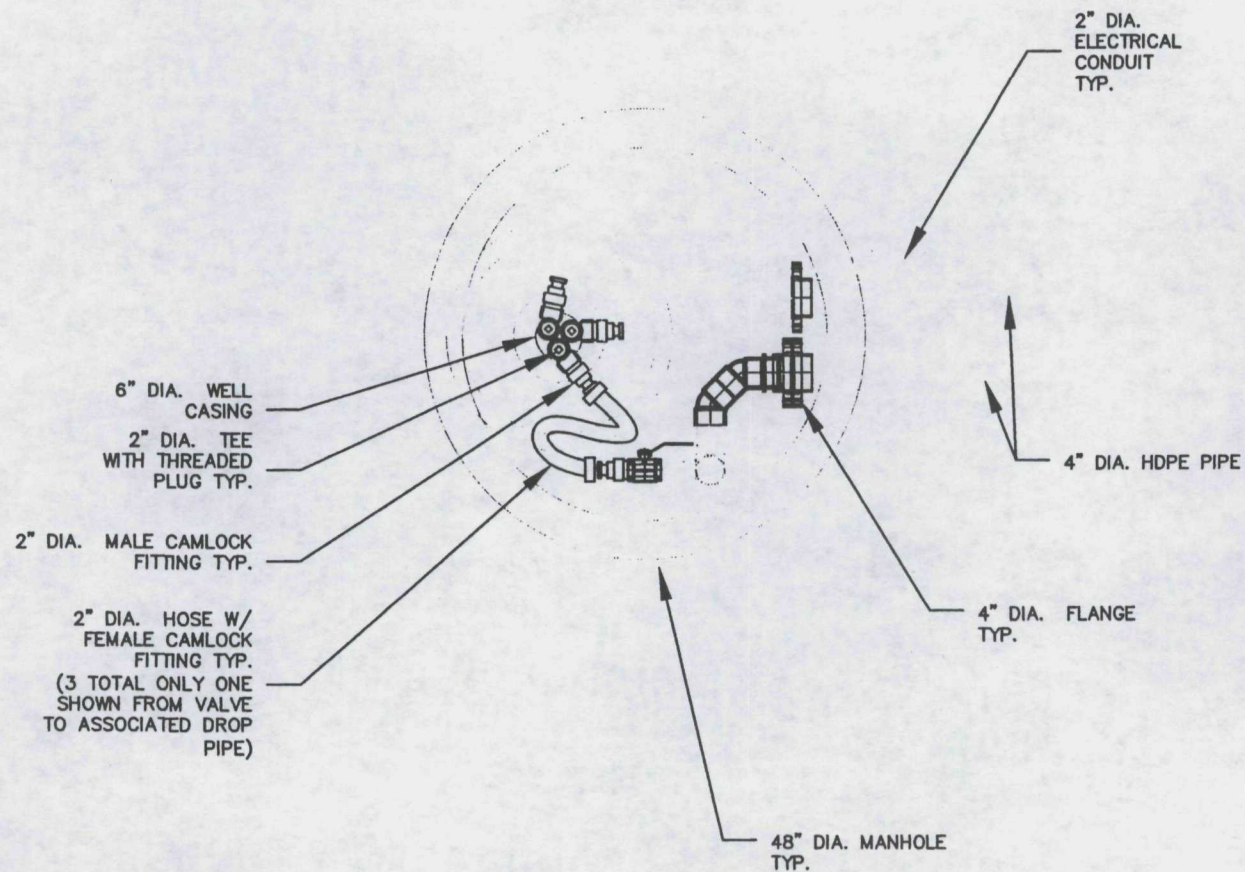
CHECKED BY: JE EDITED BY: JRD

FILE NAME: INJECTION WELL DETAIL

FIGURE 1
TYPICAL INJECTION WELL
CROSS-SECTION

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

SCALE IN FEET



E A R T H T E C H

A tyco INTERNATIONAL LTD. COMPANY

4135 Technology Parkway, Sheboygan, WI 53083 (920) 458-8711

DRAWN BY: JRD	DATE: FEB. 5, 2003
CHECKED BY: JE	EDITED BY: JRD
FILE NAME: INJECTION WELL DETAIL	

FIGURE 3
TYPICAL INJECTION WELL
PLAN DETAIL

DAYTON THERMAL PRODUCTS SITE
DAYTON, OHIO

0 2
SCALE IN FEET

**Injection Well Estimated VOC Concentration Analysis
Dayton Thermal Products Facility
Dayton, Ohio**

Introduction

The objective of this document is to estimate the relative injection stream concentration by analyzing data collected from monitoring points located in the vicinity of the proposed extraction well locations on-site.

The soil remediation approach for the Dayton Thermal Products facility consists of the construction and operation of a site wide soil vapor extraction system. This system will operate ahead of and during the operation of the proposed groundwater extraction system discussed below.

The groundwater remedial approach for the Dayton Thermal Products facility consists of the construction and operation of a groundwater containment system along the south and east property boundaries and an on-site groundwater remediation system using a combination of air stripping and in-situ reductive dechlorination technologies. The groundwater containment system design will prevent off-site migration of chlorinated volatile organic compounds (CVOCs) and establish hydraulic control of groundwater flow at the site. The reductive dechlorination technology consists of the up-gradient re-injection of groundwater augmented with sodium lactate to promote in-situ reductive dechlorination of VOCs. The reductive dechlorination will degrade the PCE, TCE, DCE, and VC to ethane and ethane. In addition, this approach will significantly reduce the timeframe for operating a conventional groundwater containment system.

An estimated groundwater extraction rate of 600 gpm (100 gpm from six extraction wells) will be required to maintain capture of the groundwater plume at the south and east property boundaries. To accommodate the dosing of the aquifer with sodium lactate, approximately 400 gpm of the groundwater will be re-injected on site into the central portion of the contaminant plume within the capture zone of the extraction wells. The re-injected groundwater is eventually recovered by the groundwater containment system, creating in effect, a closed-loop bio-reactor designed for the degradation of CVOCs. The remaining 200 gpm of groundwater removed by the extraction wells will be treated with an air stripper and discharged to the storm sewer under an NPDES permit to maintain a negative groundwater balance on-site. This document describes the methodology used to estimate the CVOC concentrations in groundwater that will be re-injected into aquifer.

MCL Exceedances

To determine the dissolved chemicals of interest for this project, the site's analytical database was used to list all chemicals that exceeded their maximum contaminant limit (MCL) for drinking water. The USEPA criteria were compared to all analytical data collected in the last four sampling events. The events occurred on August 2001, October 2001, December 2001 and March 2002. All data collected from groundwater wells and piezometers that exceeded the MCL criteria are listed in Table A attached. From this list the list of chemicals of interest were compiled. The chemicals that exceeded the MCLs during the last four sampling events are as follows:

1,1,1-Trichloroethane (MCL = 200 ug/L);
1,1-Dichloroethene (MCL = 7 ug/L);
1,2-Dichloroethane (MCL = 5 ug/L);
Carbon Tetrachloride (MCL = 5 ug/L);
Cis-1, 2-Dichloroethene (MCL = 70 ug/L);
Tetrachloroethene (MCL = 5 ug/L);
Trichloroethene (MCL = 5 ug/L); and
Vinyl Chloride (MCL = 2 ug/L).

Because these are the only compounds that exceed the MCLs for the purposes of this analysis, only these data were compiled for the estimate of injection concentrations.

Estimated Extraction Well VOC Concentrations

The groundwater re-injection CVOC concentrations are estimated based on the average concentration of groundwater in the immediate vicinity of each of the six extraction wells. The estimated concentration of groundwater removed from each of the six extraction wells has been calculated based on the laboratory analytical results from groundwater monitoring wells in close proximity to each of the proposed extraction well locations. The location of the proposed extraction and re-injection wells are presented on Figure 1. The location of the existing groundwater monitoring wells in the vicinity of the proposed extraction wells are presented on Figure 2 through 7. The well construction, well separation distance, and groundwater flow gradient information for the groundwater monitoring wells in the vicinity of the proposed extraction wells is summarized in Table 1.

Table 1: Groundwater Monitoring Well Data

Extraction Well	Adjacent Monitoring Well	Monitoring Well Screen Interval (Feet BGS)	Separation Distance (Feet)	Groundwater Flow Gradient From EW
EW-1	MW008S	19-29	17	Down
	PZ008I	53-55	7	Up
	PZ008D	77-70	50	Side
EW-2	MWA004	35-45	80	Side
	PZ009D	66-68	57	Side
	MW010S	19-29	110	Side
	PZ010I	48-50	129	Side
EW-3	MW011S	19-29	77	Side
	MWB003	46-56	101	Side
	MWC003	74-84	111	Side
EW-4	PZ012D	82-84	54	Up
	PZ012I	56-58	73	Up
	MWA006	30-40	91	Up
EW-5	PZ013I	46-48	55	Side
	MWA005	29-39	82	Side/Up
EW-6	PZ017D	82-84	177	Side
	PZ017I	56-58	168	Side
	MW018S	20-30	171	Side
	MWB002	77-87	194	Side

The laboratory analytical data for the chemicals of interest collected in the last four sampling events for each of the groundwater monitoring wells identified in Table 1 was compiled for each proposed extraction well (Tables B-F). The groundwater sampling events used for this analysis were the same evaluated for MCL exceedances above. If a value was not detected for a chemical of interest, one half of the detection limit was inserted as a "modified result" (Tables B-F) to be conservative and if the value was above the detection limit then the given value was inserted as a "modified result."

The estimated extraction well concentration for each sampling event was calculated from the modified results with all depth intervals equally weighted. If there is more than one monitoring point for a given depth interval (i.e., shallow, intermediate, or deep), the mean concentration for that depth interval was calculated first and then the overall mean was calculated using the mean for each depth interval to estimate the extraction well concentration. For each extraction well, the highest estimated concentration for each chemical of interest (from the four sampling events) was selected to establish the maximum value for each compound per extraction well. The concentrations of the chemicals of interest, modified results, estimated

concentrations for each extraction well per sampling event and maximum value of the estimated concentrations are presented in Tables B-F.

Table G provides a summary of the estimated concentrations per sample event and the estimated maximum value for each of the six-extraction wells.

Injection Concentrations

The distribution piping interconnecting the six extraction wells has been designed with two distribution header pipes and valves to allow groundwater from individual extraction wells to be routed to the re-injection wells or to storm sewer discharge via the air stripper. Each distribution header pipe has also been sized to handle the discharge from all extraction wells combined. During system operation in the latter case, the discharge from the extraction wells will go into a single header and be combined. The combined flow from the header will be split for re-injection and/or air stripping with subsequent discharge to the sewer. The planned piping configuration allows for the operator to vary what water streams are directed to the air stripper and which water streams are re-injected.

Due to these possible configurations, three combinations of the extraction well streams have been calculated to estimate the highest anticipated re-injection concentration. In all cases, the mean of the each sampling event and the maximum value concentration from each extraction well was used because the flow-rate from each well will be the same. First, a combination of the four extraction wells with the highest estimated concentrations (EW 1,2, 3 and 4) were analyzed. Next, the combination of the four extraction wells with the lowest estimated concentrations (EW 3, 4, 5 and 6) were calculated. The final combination assumes that all six of the extraction wells will be combined and part of the combined flow will be re-injected. A summary of the data for the above extraction well combinations, as well as, the maximum value of the maximum value from all combinations is shown on Table H.

The highest average concentration has been calculated by taking the maximum value for each chemical of interest from the list of the overall maximum values from each combination analyzed and shown in Table H and in Table 2 below.

Table 2: Maximum Concentrations Possible From Combinations Analyzed

Chemical of Interest	Highest Average Concentration Combined (ug/l)
1,1,1-Trichloroethane	590.7
1,1-Dichloroethene	104.6
1,2-Dichloroethane	94.3
Carbon Tetrachloride	94.3
Cis-1, 2-Dichloroethene	875.3
Tetrachloroethene	1593.5
Trichloroethene	4484.0
Vinyl Chloride	94.3

TABLE A
MCL Exceedances for Sampling Events
August 2001, October 2001, December 2001 and March 2002

SAMPDATE	SAMPLEID	LABSAMPLEID	LOCATION	ANLYDATE	RECDATE	CAS	PARAMETER	RESULTS.RESULT	RESULTS.QUALIFIER	MCL Standard	UNITS	MATRIX	HEPLIMIT	METHOD
3/26/2002	1MW007S		1MW007S	3/28/2002	3/27/2002	79-01-6	Trichloroethene	20			7 UGL	WATER	100	SW-846 8260B
3/26/2002	2MW018S		MW018S	3/28/2002	3/27/2002	127-18-4	Tetrachloroethene	570			70 UGL	WATER	21	SW-846 8260B
3/26/2002	2MW018S		MW018S	3/27/2002	3/27/2002	79-01-6	Trichloroethene	45			5 UGL	WATER	14	SW-846 8260B
3/26/2002	2MW018S		MW018S	3/28/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethene	280			200 UGL	WATER	14	SW-846 8260B
8/2/2001	MW007S		MW007S	8/9/2001	8/3/2001	79-01-6	Trichloroethene	85			70 UGL	WATER	91	SW-846 8260B
10/15/2001	MW007S	3707960	MW007S	10/22/2001	10/16/2001	79-01-6	Trichloroethene	67			5 UGL	WATER	31	SW-846 8260B
12/10/2001	MW007S	3742417	MW007S	12/13/2001	12/11/2001	79-01-6	Trichloroethene	93			200 UGL	WATER	31	SW-846 8260B
8/2/2001	MW008S		MW008S	8/10/2001	8/3/2001	79-01-6	Trichloroethene	440			5 UGL	WATER	31	SW-846 8260B
8/2/2001	MW008S		MW008S	8/10/2001	8/3/2001	127-18-4	Tetrachloroethene	1100			7 UGL	WATER	31	SW-846 8260B
10/17/2001	MW008S	3709930	MW008S	10/24/2001	10/18/2001	127-18-4	Tetrachloroethene	1100			70 UGL	WATER	16	SW-846 8260B
10/17/2001	MW008S	3709930	MW008S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	510			70 UGL	WATER	420	SW-846 8260B
12/12/2001	MW008S	3744801	MW008S	12/19/2001	12/14/2001	79-01-6	Trichloroethene	430			5 UGL	WATER	2	SW-846 8260B
12/12/2001	MW008S	3744801	MW008S	12/19/2001	12/14/2001	127-18-4	Tetrachloroethene	1000			5 UGL	WATER	10	SW-846 8260B
3/26/2002	MW008S		MW008S	3/28/2002	3/27/2002	79-01-6	Trichloroethene	440			5 UGL	WATER	5	SW-846 8260B
3/26/2002	MW008S		MW008S	3/28/2002	3/27/2002	127-18-4	Tetrachloroethene	1100			5 UGL	WATER	5	SW-846 8260B
8/2/2001	MW008S DUPLICATE		MW008S	8/10/2001	8/3/2001	127-18-4	Tetrachloroethene	1100			2 UGL	WATER	5	SW-846 8260B
8/2/2001	MW008S DUPLICATE		MW008S	8/10/2001	8/3/2001	79-01-6	Trichloroethene	450			2 UGL	WATER	1	SW-846 8260B
8/2/2001	MW010S		MW010S	8/9/2001	8/3/2001	79-01-6	Trichloroethene	7200			5 UGL	WATER	42	SW-846 8260B
8/2/2001	MW010S		MW010S	8/9/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	1000			5 UGL	WATER	42	SW-846 8260B
10/17/2001	MW010S	3709933	MW010S	10/23/2001	10/18/2001	75-01-4	Vinyl chloride	9	J		70 UGL	WATER	42	SW-846 8260B
10/17/2001	MW010S	3709933	MW010S	10/23/2001	10/18/2001	75-35-4	1,1-Dichloroethene	23	J		200 UGL	WATER	100	SW-846 8260B
10/17/2001	MW010S	3709933	MW010S	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	23	J		5 UGL	WATER	10	SW-846 8260B
10/17/2001	MW010S	3709933	MW010S	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethene	930			5 UGL	WATER	25	SW-846 8260B
10/17/2001	MW010S	3709933	MW010S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	7600			7 UGL	WATER	100	SW-846 8260B
12/12/2001	MW010S	3744805	MW010S	12/18/2001	12/14/2001	75-35-4	1,1-Dichloroethene	26			5 UGL	WATER	2	SW-846 8260B
12/12/2001	MW010S	3744805	MW010S	12/19/2001	12/14/2001	79-01-6	Trichloroethene	8300			5 UGL	WATER	100	SW-846 8260B
12/12/2001	MW010S	3744805	MW010S	12/19/2001	12/14/2001	156-59-2	cis-1,2-Dichloroethene	1000			5 UGL	WATER	830	SW-846 8260B
12/12/2001	MW010S	3744805	MW010S	12/19/2001	12/14/2001	127-18-4	Tetrachloroethene	56			200 UGL	WATER	200	SW-846 8260B
3/27/2002	MW010S		MW010S	4/9/2002	3/28/2002	75-01-4	Vinyl chloride	43			5 UGL	WATER	200	SW-846 8260B
3/27/2002	MW010S		MW010S	4/9/2002	3/28/2002	75-35-4	1,1-Dichloroethene	15	J		70 UGL	WATER	100	SW-846 8260B
3/27/2002	MW010S		MW010S	4/9/2002	3/28/2002	156-59-2	cis-1,2-Dichloroethene	560			200 UGL	WATER	25	SW-846 8260B
3/27/2002	MW010S		MW010S	4/4/2002	3/28/2002	79-01-6	Trichloroethene	5700			70 UGL	WATER	50	SW-846 8260B
8/2/2001	MW011S		MW011S	8/9/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	270			7 UGL	WATER	25	SW-846 8260B
8/2/2001	MW011S		MW011S	8/9/2001	8/3/2001	79-01-6	Trichloroethene	2500			5 UGL	WATER	330	SW-846 8260B
10/17/2001	MW011S	3709936	MW011S	10/23/2001	10/18/2001	75-01-4	Vinyl chloride	4	J		70 UGL	WATER	42	SW-846 8260B
10/17/2001	MW011S	3709936	MW011S	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethene	180			5 UGL	WATER	1	SW-846 8260B
10/17/2001	MW011S	3709936	MW011S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	1800			5 UGL	WATER	330	SW-846 8260B
10/17/2001	MW011S	3709936	MW011S	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	25			5 UGL	WATER	1	SW-846 8260B
12/12/2001	MW011S	3744808	MW011S	12/19/2001	12/14/2001	75-01-4	Vinyl chloride	11			5 UGL	WATER	3.3	SW-846 8260B
12/12/2001	MW011S	3744808	MW011S	12/19/2001	12/14/2001	79-01-6	Trichloroethene	2200			5 UGL	WATER	3.3	SW-846 8260B
12/12/2001	MW011S	3744808	MW011S	12/19/2001	12/14/2001	156-59-2	cis-1,2-Dichloroethene	210			5 UGL	WATER	1	SW-846 8260B
3/27/2002	MW011S		MW011S	3/30/2002	3/28/2002	75-01-4	Vinyl chloride	13			70 UGL	WATER	12	SW-846 8260B
3/27/2002	MW011S		MW011S	4/1/2002	3/28/2002	79-01-6	Trichloroethene	1200			5 UGL	WATER	83	SW-846 8260B
3/27/2002	MW011S		MW011S	3/30/2002	3/28/2002	156-59-2	cis-1,2-Dichloroethene	150			5 UGL	WATER	1	SW-846 8260B
10/17/2001	MW011S-DUP	3709937	MW011S	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	24			70 UGL	WATER	5	SW-846 8260B
10/17/2001	MW011S-DUP	3709937	MW011S	10/23/2001	10/18/2001	75-01-4	Vinyl chloride	4	J		5 UGL	WATER	1	SW-846 8260B
10/17/2001	MW011S-DUP	3709937	MW011S	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethene	190			5 UGL	WATER	1	SW-846 8260B
10/17/2001	MW011S-DUP	3709937	MW011S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	1800			70 UGL	WATER	1	SW-846 8260B
8/2/2001	MW015S		MW015S	8/9/2001	8/3/2001	127-18-4	Tetrachloroethene	70			5 UGL	WATER	2	SW-846 8260B
10/15/2001	MW015S	3707956	MW015S	10/22/2001	10/16/2001	127-18-4	Tetrachloroethene	120			5 UGL	WATER	1	SW-846 8260B
12/10/2001	MW015S	3742413	MW015S	12/13/2001	12/11/2001	127-18-4	Tetrachloroethene	120			5 UGL	WATER	1	SW-846 8260B
3/27/2002	MW015S		MW015S	3/28/2002	3/28/2002	127-18-4	Tetrachloroethene	110			5 UGL	WATER	1	SW-846 8260B
3/27/2002	MW015SDUP		MW015SDUP	3/28/2002	3/28/2002	127-18-4	Tetrachloroethene	110			5 UGL	WATER	1	SW-846 8260B
8/2/2001	MW018S		MW018S	8/10/2001	8/3/2001	127-18-4	Tetrachloroethene	440			2 UGL	WATER	1	SW-846 8260B
8/2/2001	MW018S		MW018S	8/10/2001	8/3/2001	79-01-6	Trichloroethene	46			5 UGL	WATER	1	SW-846 8260B
8/2/2001	MW018S		MW018S	8/10/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	180			5 UGL	WATER	1	SW-846 8260B
10/15/2001	MW018S	3707939	MW018S	10/22/2001	10/16/2001	79-01-6	Trichloroethene	45			2 UGL	WATER	1	SW-846 8260B
10/15/2001	MW018S	3707939	MW018S	10/23/2001	10/16/2001	127-18-4	Tetrachloroethene	510			5 UGL	WATER	1	SW-846 8260B
12/10/2001	MW018S	3742405	MW018S	12/13/2001	12/11/2001	79-01-6	Trichloroethene	54			2 UGL	WATER	1	SW-846 8260B
12/10/2001	MW018S	3742405	MW018S	12/13/2001	12/11/2001	127-18-4	Tetrachloroethene	530			5 UGL	WATER	1	SW-846 8260B

TABLE A
MCL Exceedances for Sampling Events
August 2001, October 2001, December 2001 and March 2002

SAMPLE DATE	SAMPLE ID	LAB SAMPLE ID	LOCATION	ANLY DATE	REC DATE	CAS	PARAMETER	RESULTS RESULT	RESULTS QUALIFIER	MCL Standard	UNITS	MATRIX	REPLIMIT	METHOD
12/10/2001	MW018S	3742405	MW018S	12/13/2001	12/11/2001	156-59-2	cis-1,2-Dichloroethene	150			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MW020S	3744798	MW020S	12/18/2001	12/14/2001	79-01-6	Trichloroethene	19			5 UG/L	WATER	1	SW-846 8260B
8/2/2001	MW021S		MW021S	8/10/2001	8/3/2001	79-01-6	Trichloroethene	10			5 UG/L	WATER	1	SW-846 8260B
8/2/2001	MW021S		MW021S	8/10/2001	8/3/2001	75-01-4	Vinyl chloride	31			7 UG/L	WATER	1	SW-846 8260B
8/2/2001	MW021S		MW021S	8/10/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	130			70 UG/L	WATER	1	SW-846 8260B
8/2/2001	MW023S		MW023S	8/10/2001	8/3/2001	75-01-4	Vinyl chloride	760			5 UG/L	WATER	1	SW-846 8260B
8/2/2001	MW023S		MW023S	8/10/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	6700			200 UG/L	WATER	2	SW-846 8260B
10/16/2001	MW025S	3708802	MW025S	10/22/2001	10/17/2001	79-01-6	Trichloroethene	200			5 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW025S	3708802	MW025S	10/22/2001	10/17/2001	156-59-2	cis-1,2-Dichloroethene	83			5 UG/L	WATER	1	SW-846 8260B
12/11/2001	MW025S	3743181	MW025S	12/15/2001	12/12/2001	79-01-6	Trichloroethene	240			2 UG/L	WATER	1	SW-846 8260B
12/11/2001	MW025S	3743181	MW025S	12/15/2001	12/12/2001	156-59-2	cis-1,2-Dichloroethene	80			2 UG/L	WATER	1	SW-846 8260B
3/25/2002	MW025S		MW025S	3/29/2002	3/27/2002	79-01-6	Trichloroethene	200			5 UG/L	WATER	5	SW-846 8260B
10/16/2001	MW025S-DUP	3708803	MW025S-DUP	10/22/2001	10/17/2001	79-01-6	Trichloroethene	180			2 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW025S-DUP	3708803	MW025S-DUP	10/22/2001	10/17/2001	156-59-2	cis-1,2-Dichloroethene	77			5 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW028S	3708798	MW028S	10/22/2001	10/17/2001	79-01-6	Trichloroethene	6			5 UG/L	WATER	2	SW-846 8260B
12/11/2001	MW028S	3743179	MW028S	12/14/2001	12/12/2001	79-01-6	Trichloroethene	14			7 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW028S	3708809	MW028S	10/19/2001	10/17/2001	156-59-2	cis-1,2-Dichloroethene	1100			70 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW028S	3708809	MW028S	10/19/2001	10/17/2001	75-35-4	1,1-Dichloroethene	27	J		5 UG/L	WATER	25	SW-846 8260B
10/16/2001	MW028S	3708809	MW028S	10/19/2001	10/17/2001	75-01-4	Vinyl chloride	11	J		70 UG/L	WATER	10	SW-846 8260B
10/16/2001	MW028S	3708809	MW028S	10/22/2001	10/17/2001	79-01-6	Trichloroethene	8200			7 UG/L	WATER	10	SW-846 8260B
12/11/2001	MW028S	3743173	MW028S	12/14/2001	12/12/2001	75-01-4	Vinyl chloride	10	J		2 UG/L	WATER	10	SW-846 8260B
12/11/2001	MW028S	3743173	MW028S	12/14/2001	12/12/2001	156-59-2	cis-1,2-Dichloroethene	1200			5 UG/L	WATER	5	SW-846 8260B
12/11/2001	MW028S	3743173	MW028S	12/14/2001	12/12/2001	75-35-4	1,1-Dichloroethene	24	J		5 UG/L	WATER	5	SW-846 8260B
12/11/2001	MW028S	3743173	MW028S	12/14/2001	12/12/2001	107-06-2	1,2-Dichloroethane	7	J		5 UG/L	WATER	1	SW-846 8260B
12/11/2001	MW028S	3743173	MW028S	12/14/2001	12/12/2001	79-01-6	Trichloroethene	8200			5 UG/L	WATER	1	SW-846 8260B
3/27/2002	MW028S		MW028S	4/4/2002	3/28/2002	79-01-6	Trichloroethene	10000			70 UG/L	WATER	1	SW-846 8260B
3/27/2002	MW028S		MW028S	4/9/2002	3/28/2002	75-35-4	1,1-Dichloroethene	25	J		5 UG/L	WATER	1	SW-846 8260B
3/27/2002	MW028S		MW028S	4/9/2002	3/28/2002	156-59-2	cis-1,2-Dichloroethene	1100			5 UG/L	WATER	10	SW-846 8260B
10/16/2001	MW029S	3708822	MW029S	10/19/2001	10/17/2001	156-59-2	cis-1,2-Dichloroethene	240			70 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW029S	3708822	MW029S	10/22/2001	10/17/2001	79-01-6	Trichloroethene	3600			70 UG/L	WATER	1	SW-846 8260B
12/11/2001	MW029S	3743196	MW029S	12/15/2001	12/12/2001	79-01-6	Trichloroethene	9900			5 UG/L	WATER	50	SW-846 8260B
12/11/2001	MW029S	3743196	MW029S	12/15/2001	12/12/2001	156-59-2	cis-1,2-Dichloroethene	470			70 UG/L	WATER	1	SW-846 8260B
3/27/2002	MW029S		MW029S	4/9/2002	3/28/2002	75-01-4	Vinyl chloride	110			5 UG/L	WATER	1	SW-846 8260B
3/27/2002	MW029S		MW029S	4/9/2002	3/28/2002	156-59-2	cis-1,2-Dichloroethene	880			5 UG/L	WATER	1	SW-846 8260B
3/27/2002	MW029S		MW029S	4/4/2002	3/28/2002	79-01-6	Trichloroethene	19000			5 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW030S	3708812	MW030S	10/19/2001	10/17/2001	79-01-6	Trichloroethene	7			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MW030S	3744811	MW030S	12/19/2001	12/14/2001	79-01-6	Trichloroethene	27			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MW030S	3744811	MW030S	12/19/2001	12/14/2001	127-18-4	Tetrachloroethene	12			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MW030S/DUP	3744812	MW030S/DUP	12/19/2001	12/14/2001	79-01-6	Trichloroethene	30			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MW030S/DUP	3744812	MW030S/DUP	12/19/2001	12/14/2001	127-18-4	Tetrachloroethene	14			2 UG/L	WATER	1	SW-846 8260B
10/17/2001	MW032S	3709914	MW032S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	490			70 UG/L	WATER	10	SW-846 8260B
12/11/2001	MW032S	3743202	MW032S	12/15/2001	12/12/2001	79-01-6	Trichloroethene	550			5 UG/L	WATER	1	SW-846 8260B
3/25/2002	MW032S		MW032S	4/1/2002	3/27/2002	79-01-6	Trichloroethene	350			5 UG/L	WATER	5	SW-846 8260B
12/11/2001	MW032S/DUP	3743203	MW032S/DUP	12/15/2001	12/12/2001	79-01-6	Trichloroethene	530			5 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW033S	3708815	MW033S	10/22/2001	10/17/2001	79-01-6	Trichloroethene	890			5 UG/L	WATER	10	SW-846 8260B
10/16/2001	MW033S	3708815	MW033S	10/19/2001	10/17/2001	156-59-2	cis-1,2-Dichloroethene	110			7 UG/L	WATER	1	SW-846 8260B
12/11/2001	MW033S	3743198	MW033S	12/15/2001	12/12/2001	156-59-2	cis-1,2-Dichloroethene	140			5 UG/L	WATER	1	SW-846 8260B
12/11/2001	MW033S	3743198	MW033S	12/16/2001	12/12/2001	79-01-6	Trichloroethene	920			200 UG/L	WATER	1	SW-846 8260B
3/25/2002	MW033S		MW033S	4/1/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethene	240			5 UG/L	WATER	10	SW-846 8260B
3/25/2002	MW033S		MW033S	3/29/2002	3/27/2002	79-01-6	Trichloroethene	1400			2 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW034S	3708818	MW034S	10/22/2001	10/17/2001	79-01-6	Trichloroethene	490			7 UG/L	WATER	1	SW-846 8260B
12/11/2001	MW034S	3743193	MW034S	12/16/2001	12/12/2001	79-01-6	Trichloroethene	350			70 UG/L	WATER	10	SW-846 8260B
3/25/2002	MW034S		MW034S	3/29/2002	3/27/2002	75-01-4	Vinyl chloride	3	J		5 UG/L	WATER	1	SW-846 8260B
3/25/2002	MW034S		MW034S	4/1/2002	3/27/2002	79-01-6	Trichloroethene	370			5 UG/L	WATER	1	SW-846 8260B
10/16/2001	MW034S-DUP	3708819	MW034S-DUP	10/22/2001	10/17/2001	79-01-6	Trichloroethene	450			2 UG/L	WATER	3	SW-846 8260B
10/17/2001	MW035S	3709916	MW035S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	570			5 UG/L	WATER	3	SW-846 8260B
12/12/2001	MW035S	3744815	MW035S	12/20/2001	12/14/2001	79-01-6	Trichloroethene	500			7 UG/L	WATER	3	SW-846 8260B
12/12/2001	MW035S	3744815	MW035S	12/20/2001	12/14/2001	127-18-4	Tetrachloroethene	9			70 UG/L	WATER	25	SW-846 8260B
3/25/2002	MW035S		MW035S	4/1/2002	3/27/2002	79-01-6	Trichloroethene	460			200 UG/L	WATER	3	SW-846 8260B
10/17/2001	MW036S	3709911	MW036S	10/24/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethene	150			5 UG/L	WATER	25	SW-846 8260B

TABLE A
MCL Exceedances for Sampling Events
August 2001, October 2001, December 2001 and March 2002

SAMPLE DATE	SAMPLE ID	LAB SAMPLE ID	LOCATION	ANLY DATE	RECD DATE	CAS	PARAMETER	RESULTS RESULT	RESULTS QUALIFIER	MCL Standard	UNITS	MATRIX	RFPLIMIT	METHOD
10/17/2001	MW038S	3709911	MW038S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	1500			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MW038S	3744823	MW038S	12/20/2001	12/14/2001	156-59-2	cis-1,2-Dichloroethene	100			5 UG/L	WATER	20	SW-846 8260B
12/12/2001	MW038S	3744823	MW038S	12/20/2001	12/14/2001	79-01-6	Trichloroethene	1400			7 UG/L	WATER	20	SW-846 8260B
3/25/2002	MW038S		MW038S	4/11/2002	3/27/2002	79-01-6	Trichloroethene	1700			5 UG/L	WATER	20	SW-846 8260B
3/25/2002	MW038S		MW038S	3/29/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethene	140			5 UG/L	WATER	1	SW-846 8260B
10/17/2001	MW037S	3709920	MW037S	10/23/2001	10/18/2001	79-01-6	Trichloroethene	990			200 UG/L	WATER	20	SW-846 8260B
12/12/2001	MW037S	3744818	MW037S	12/20/2001	12/14/2001	79-01-6	Trichloroethene	65			70 UG/L	WATER	1	SW-846 8260B
3/25/2002	MW037S		MW037S	3/29/2002	3/27/2002	79-01-6	Trichloroethene	890			5 UG/L	WATER	20	SW-846 8260B
10/17/2001	MW038S	3709908	MW038S	10/24/2001	10/18/2001	79-01-6	Trichloroethene	660			200 UG/L	WATER	20	SW-846 8260B
12/12/2001	MW038S	3744821	MW038S	12/20/2001	12/14/2001	79-01-6	Trichloroethene	700			5 UG/L	WATER	5	SW-846 8260B
3/25/2002	MW038S		MW038S	4/11/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethene	74			70 UG/L	WATER	20	SW-846 8260B
3/25/2002	MW038S		MW038S	4/11/2002	3/27/2002	79-01-6	Trichloroethene	830			70 UG/L	WATER	1	SW-846 8260B
10/18/2001	MW038S	3708791	MW038S	10/23/2001	10/17/2001	79-01-6	Trichloroethene	240			5 UG/L	WATER	20	SW-846 8260B
12/11/2001	MW038S	3743188	MW038S	12/18/2001	12/12/2001	79-01-6	Trichloroethene	270			5 UG/L	WATER	10	SW-846 8260B
12/17/2001	MW038S	3743188	MW038S	12/15/2001	12/12/2001	156-59-2	cis-1,2-Dichloroethene	74			5 UG/L	WATER	10	SW-846 8260B
3/27/2002	MW038S		MW038S	4/4/2002	3/29/2002	79-01-6	Trichloroethene	450			7 UG/L	WATER	1	SW-846 8260B
10/17/2001	MWA001	3709922	MWA001	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	920			5 UG/L	WATER	5	SW-846 8260B
10/17/2001	MWA001	3709922	MWA001	10/23/2001	10/18/2001	79-01-6	Trichloroethene	580			5 UG/L	WATER	10	SW-846 8260B
10/17/2001	MWA001	3709922	MWA001	10/23/2001	10/18/2001	71-55-6	1,1,1-Trichloroethane	1800			7 UG/L	WATER	1	SW-846 8260B
10/17/2001	MWA001	3709922	MWA001	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethane	2400			70 UG/L	WATER	1	SW-846 8260B
10/17/2001	MWA001	3709922	MWA001	10/23/2001	10/18/2001	75-35-4	1,1-Dichloroethane	69			200 UG/L	WATER	10	SW-846 8260B
12/12/2001	MWA001	3744795	MWA001	12/19/2001	12/14/2001	127-18-4	Tetrachloroethene	720			5 UG/L	WATER	10	SW-846 8260B
12/12/2001	MWA001	3744795	MWA001	12/19/2001	12/14/2001	79-01-6	Trichloroethene	480			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MWA001	3744795	MWA001	12/19/2001	12/14/2001	71-55-6	1,1,1-Trichloroethane	1000			5 UG/L	WATER	2	SW-846 8260B
12/12/2001	MWA001	3744795	MWA001	12/19/2001	12/14/2001	156-59-2	cis-1,2-Dichloroethane	2700			2 UG/L	WATER	2	SW-846 8260B
12/12/2001	MWA001	3744795	MWA001	12/19/2001	12/14/2001	75-35-4	1,1-Dichloroethane	32			7 UG/L	WATER	2	SW-846 8260B
3/28/2002	MWA001		MWA001	3/30/2002	3/27/2002	75-35-4	1,1-Dichloroethane	42			70 UG/L	WATER	25	SW-846 8260B
3/28/2002	MWA001		MWA001	4/11/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethane	2200			7 UG/L	WATER	2	SW-846 8260B
3/28/2002	MWA001		MWA001	4/11/2002	3/27/2002	71-55-6	1,1,1-Trichloroethane	1000			5 UG/L	WATER	25	SW-846 8260B
3/28/2002	MWA001		MWA001	4/11/2002	3/27/2002	79-01-6	Trichloroethene	390			5 UG/L	WATER	25	SW-846 8260B
3/28/2002	MWA001		MWA001	4/11/2002	3/27/2002	127-18-4	Tetrachloroethene	760			5 UG/L	WATER	10	SW-846 8260B
8/2/2001	MWA002		MWA002	8/10/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethane	340			5 UG/L	WATER	1	SW-846 8260B
8/2/2001	MWA002		MWA002	8/10/2001	8/3/2001	127-18-4	Tetrachloroethene	1500			2 UG/L	WATER	5	SW-846 8260B
8/2/2001	MWA002		MWA002	8/10/2001	8/3/2001	79-01-6	Trichloroethene	120			7 UG/L	WATER	5	SW-846 8260B
8/2/2001	MWA002		MWA002	8/10/2001	8/3/2001	71-55-6	1,1,1-Trichloroethane	340			5 UG/L	WATER	5	SW-846 8260B
10/17/2001	MWA002	3709925	MWA002	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	1500			70 UG/L	WATER	5	SW-846 8260B
10/17/2001	MWA002	3709925	MWA002	10/23/2001	10/18/2001	79-01-6	Trichloroethene	120			5 UG/L	WATER	50	SW-846 8260B
10/17/2001	MWA002	3709925	MWA002	10/23/2001	10/18/2001	71-55-6	1,1,1-Trichloroethane	270			2 UG/L	WATER	1	SW-846 8260B
10/17/2001	MWA002	3709925	MWA002	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethane	110			70 UG/L	WATER	1	SW-846 8260B
12/12/2001	MWA002	3744799	MWA002	12/19/2001	12/14/2001	156-59-2	cis-1,2-Dichloroethane	84			5 UG/L	WATER	20	SW-846 8260B
12/12/2001	MWA002	3744799	MWA002	12/19/2001	12/14/2001	79-01-6	Trichloroethene	100			5 UG/L	WATER	1	SW-846 8260B
12/12/2001	MWA002	3744799	MWA002	12/19/2001	12/14/2001	127-18-4	Tetrachloroethene	1600			2 UG/L	WATER	1	SW-846 8260B
12/12/2001	MWA002	3744799	MWA002	12/19/2001	12/14/2001	71-55-6	1,1,1-Trichloroethane	280			70 UG/L	WATER	1	SW-846 8260B
3/28/2002	MWA002		MWA002	3/28/2002	3/27/2002	79-01-6	Trichloroethene	86			5 UG/L	WATER	20	SW-846 8260B
3/28/2002	MWA002		MWA002	3/28/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethane	1300			5 UG/L	WATER	20	SW-846 8260B
3/28/2002	MWA002		MWA002	3/28/2002	3/27/2002	127-18-4	Tetrachloroethene	1600			5 UG/L	WATER	20	SW-846 8260B
8/2/2001	MWA003		MWA003	8/9/2001	8/3/2001	127-18-4	Tetrachloroethene	180			7 UG/L	WATER	1	SW-846 8260B
8/2/2001	MWA003		MWA003	8/9/2001	8/3/2001	71-55-6	1,1,1-Trichloroethane	330			2 UG/L	WATER	1	SW-846 8260B
8/2/2001	MWA003		MWA003	8/9/2001	8/3/2001	79-01-6	Trichloroethene	96			5 UG/L	WATER	100	SW-846 8260B
8/2/2001	MWA003		MWA003	8/9/2001	8/3/2001	75-01-4	Vinyl chloride	14			70 UG/L	WATER	10	SW-846 8260B
8/2/2001	MWA003		MWA003	8/9/2001	8/3/2001	75-35-4	1,1-Dichloroethane	43			2 UG/L	WATER	10	SW-846 8260B
8/2/2001	MWA003		MWA003	8/9/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethane	200			5 UG/L	WATER	1	SW-846 8260B
10/15/2001	MWA003	3707949	MWA003	10/23/2001	10/16/2001	79-01-6	Trichloroethene	110			5 UG/L	WATER	1	SW-846 8260B
10/15/2001	MWA003	3707949	MWA003	10/23/2001	10/16/2001	75-35-4	1,1-Dichloroethane	17			5 UG/L	WATER	1	SW-846 8260B
10/15/2001	MWA003	3707949	MWA003	10/23/2001	10/16/2001	156-59-2	cis-1,2-Dichloroethane	140			70 UG/L	WATER	1	SW-846 8260B
10/15/2001	MWA003	3707949	MWA003	10/23/2001	10/16/2001	71-55-6	1,1,1-Trichloroethane	280			2 UG/L	WATER	1	SW-846 8260B
10/15/2001	MWA003	3707949	MWA003	10/23/2001	10/16/2001	127-18-4	Tetrachloroethene	130			5 UG/L	WATER	100	SW-846 8260B
10/15/2001	MWA003	3707949	MWA003	10/23/2001	10/16/2001	75-01-4	Vinyl chloride	7			5 UG/L	WATER	10	SW-846 8260B
12/10/2001	MWA003	3742409	MWA003	12/13/2001	12/11/2001	79-01-6	Trichloroethene	130			70 UG/L	WATER	10	SW-846 8260B
12/10/2001	MWA003	3742409	MWA003	12/13/2001	12/11/2001	127-18-4	Tetrachloroethene	150			5 UG/L	WATER	1	SW-846 8260B

TABLE A
MCL Exceedances for Sampling Events
August 2001, October 2001, December 2001 and March 2002

SAMPLE DATE	SAMPLE ID	LAB SAMPLE ID	LOCATION	ANLY DATE	REC DATE	CAS	PARAMETER	RESULTS RESULT	RESULTS QUALIFIER	MCL Standard	UNITS	MATRIX	REPLIMIT	METHOD
12/10/2001	MWA003	3742406	MWA003	12/13/2001	12/11/2001	71-55-6	1,1,1-Trichloroethane	250			7 UGL	WATER	10	SW-846 8260B
12/10/2001	MWA003	3742409	MWA003	12/13/2001	12/11/2001	156-59-2	cis-1,2-Dichloroethene	110			5 UGL	WATER	1	SW-846 8260B
12/10/2001	MWA003	3742409	MWA003	12/13/2001	12/11/2001	75-35-4	1,1-Dichloroethene	12			2 UGL	WATER	2	SW-846 8260B
12/10/2001	MWA003	3742409	MWA003	12/13/2001	12/11/2001	75-01-4	Vinyl chloride	5			2 UGL	WATER	20	SW-846 8260B
3/26/2002	MWA003		MWA003	3/28/2002	3/27/2002	71-55-6	1,1,1-Trichloroethane	1100			5 UGL	WATER	20	SW-846 8260B
3/26/2002	MWA003		MWA003	3/28/2002	3/27/2002	79-01-6	Trichloroethene	250			70 UGL	WATER	2	SW-846 8260B
3/26/2002	MWA003		MWA003	3/28/2002	3/27/2002	127-18-4	Tetrachloroethene	490			5 UGL	WATER	10	SW-846 8260B
3/26/2002	MWA003		MWA003	3/28/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethene	280			70 UGL	WATER	1	SW-846 8260B
3/26/2002	MWA003		MWA003	3/28/2002	3/27/2002	75-01-4	Vinyl chloride	16			70 UGL	WATER	1	SW-846 8260B
3/26/2002	MWA003		MWA003	3/28/2002	3/27/2002	75-35-4	1,1-Dichloroethene	130			5 UGL	WATER	1	SW-846 8260B
8/2/2001	MWA004		MWA004	8/10/2001	8/3/2001	79-01-6	Trichloroethene	25000			200 UGL	WATER	10	SW-846 8260B
8/2/2001	MWA004		MWA004	8/10/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	5400			5 UGL	WATER	1	SW-846 8260B
10/17/2001	MWA004	3709932	MWA004	10/23/2001	10/18/2001	75-35-4	1,1-Dichloroethene	47	J		5 UGL	WATER	20	SW-846 8260B
10/17/2001	MWA004	3709932	MWA004	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	27	J		5 UGL	WATER	1	SW-846 8260B
10/17/2001	MWA004	3709932	MWA004	10/23/2001	10/18/2001	75-01-4	Vinyl chloride	1100			5 UGL	WATER	10	SW-846 8260B
10/17/2001	MWA004	3709932	MWA004	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethene	5100			5 UGL	WATER	10	SW-846 8260B
10/17/2001	MWA004	3709932	MWA004	10/23/2001	10/18/2001	79-01-6	Trichloroethene	26000			5 UGL	WATER	1	SW-846 8260B
12/12/2001	MWA004	3744804	MWA004	12/19/2001	12/14/2001	75-01-4	Vinyl chloride	1100			5 UGL	WATER	25	SW-846 8260B
12/12/2001	MWA004	3744804	MWA004	12/19/2001	12/14/2001	75-35-4	1,1-Dichloroethene	21	J		5 UGL	WATER	20	SW-846 8260B
12/12/2001	MWA004	3744804	MWA004	12/19/2001	12/14/2001	156-59-2	cis-1,2-Dichloroethene	4000			5 UGL	WATER	20	SW-846 8260B
12/12/2001	MWA004	3744804	MWA004	12/19/2001	12/14/2001	79-01-6	Trichloroethene	27000			70 UGL	WATER	20	SW-846 8260B
3/26/2002	MWA004		MWA004	3/29/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethene	5500			5 UGL	WATER	1	SW-846 8260B
3/26/2002	MWA004		MWA004	3/29/2002	3/27/2002	79-01-6	Trichloroethene	24000			200 UGL	WATER	20	SW-846 8260B
3/26/2002	MWA004		MWA004	3/29/2002	3/27/2002	75-35-4	1,1-Dichloroethene	41	J		5 UGL	WATER	1	SW-846 8260B
3/26/2002	MWA004		MWA004	3/29/2002	3/27/2002	75-01-4	Vinyl chloride	490			70 UGL	WATER	1	SW-846 8260B
8/2/2001	MWA005		MWA005	8/10/2001	8/3/2001	75-35-4	1,1-Dichloroethene	340			5 UGL	WATER	1	SW-846 8260B
8/2/2001	MWA005		MWA005	8/10/2001	8/3/2001	79-01-6	Trichloroethene	1700			5 UGL	WATER	1	SW-846 8260B
8/2/2001	MWA005		MWA005	8/10/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	150			5 UGL	WATER	1	SW-846 8260B
8/2/2001	MWA005		MWA005	8/10/2001	8/3/2001	71-55-6	1,1,1-Trichloroethane	2600			200 UGL	WATER	20	SW-846 8260B
10/17/2001	MWA005	3709923	MWA005	10/23/2001	10/18/2001	79-01-6	Trichloroethene	1500			70 UGL	WATER	1	SW-846 8260B
10/17/2001	MWA005	3709923	MWA005	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	85			7 UGL	WATER	20	SW-846 8260B
10/17/2001	MWA005	3709923	MWA005	10/23/2001	10/18/2001	107-06-2	1,2-Dichloroethane	6			5 UGL	WATER	20	SW-846 8260B
10/17/2001	MWA005	3709923	MWA005	10/23/2001	10/18/2001	71-55-6	1,1,1-Trichloroethane	1900			5 UGL	WATER	100	SW-846 8260B
10/17/2001	MWA005	3709923	MWA005	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethene	170			7 UGL	WATER	20	SW-846 8260B
10/17/2001	MWA005	3709923	MWA005	10/23/2001	10/18/2001	75-35-4	1,1-Dichloroethene	300			70 UGL	WATER	50	SW-846 8260B
12/12/2001	MWA005	3744793	MWA005	12/18/2001	12/14/2001	156-59-2	cis-1,2-Dichloroethene	160			200 UGL	WATER	20	SW-846 8260B
12/12/2001	MWA005	3744793	MWA005	12/19/2001	12/14/2001	75-35-4	1,1-Dichloroethene	340			70 UGL	WATER	1	SW-846 8260B
12/12/2001	MWA005	3744793	MWA005	12/18/2001	12/14/2001	127-18-4	Tetrachloroethene	68			7 UGL	WATER	1	SW-846 8260B
12/12/2001	MWA005	3744793	MWA005	12/19/2001	12/14/2001	79-01-6	Trichloroethene	1600			2 UGL	WATER	1	SW-846 8260B
12/12/2001	MWA005	3744793	MWA005	12/19/2001	12/14/2001	71-55-6	1,1,1-Trichloroethane	2000			5 UGL	WATER	5	SW-846 8260B
3/26/2002	MWA005		MWA005	3/28/2002	3/27/2002	156-59-2	cis-1,2-Dichloroethene	150			5 UGL	WATER	50	SW-846 8260B
3/26/2002	MWA005		MWA005	3/28/2002	3/27/2002	75-35-4	1,1-Dichloroethene	330			200 UGL	WATER	5	SW-846 8260B
3/26/2002	MWA005		MWA005	3/28/2002	3/27/2002	127-18-4	Tetrachloroethene	83			5 UGL	WATER	2	SW-846 8260B
3/26/2002	MWA005		MWA005	3/28/2002	3/27/2002	79-01-6	Trichloroethene	1500			7 UGL	WATER	5	SW-846 8260B
3/26/2002	MWA005		MWA005	3/28/2002	3/27/2002	71-55-6	1,1,1-Trichloroethane	1900			2 UGL	WATER	5	SW-846 8260B
10/17/2001	MWA005-DUP	3709924	MWA005	10/23/2001	10/18/2001	79-01-6	Trichloroethene	1600			5 UGL	WATER	25	SW-846 8260B
10/17/2001	MWA005-DUP	3709924	MWA005	10/23/2001	10/18/2001	107-06-2	1,2-Dichloroethane	6			200 UGL	WATER	2	SW-846 8260B
10/17/2001	MWA005-DUP	3709924	MWA005	10/23/2001	10/18/2001	71-55-6	1,1,1-Trichloroethane	2200			70 UGL	WATER	25	SW-846 8260B
10/17/2001	MWA005-DUP	3709924	MWA005	10/23/2001	10/18/2001	156-59-2	cis-1,2-Dichloroethene	170			5 UGL	WATER	5	SW-846 8260B
10/17/2001	MWA005-DUP	3709924	MWA005	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	83			70 UGL	GROUNDWA	1	SW-846 8260B
10/17/2001	MWA005-DUP	3709924	MWA005	10/23/2001	10/18/2001	75-35-4	1,1-Dichloroethene	340			5 UGL	GROUNDWA	1	SW-846 8260B
8/2/2001	MWA006		MWA006	8/9/2001	8/3/2001	71-55-6	1,1,1-Trichloroethane	540			5 UGL	GROUNDWA	5	SW-846 8260B
8/2/2001	MWA006		MWA006	8/9/2001	8/3/2001	79-01-6	Trichloroethene	3000			5 UGL	GROUNDWA	4	SW-846 8260B
8/2/2001	MWA006		MWA006	8/9/2001	8/3/2001	75-35-4	1,1-Dichloroethene	110			70 UGL	GROUNDWA	1	SW-846 8260B
8/2/2001	MWA006		MWA006	8/9/2001	8/3/2001	156-59-2	cis-1,2-Dichloroethene	700			5 UGL	GROUNDWA	1	SW-846 8260B
10/17/2001	MWA006	3709926	MWA006	10/23/2001	10/18/2001	75-35-4	1,1-Dichloroethene	130			5 UGL	GROUNDWA	1	SW-846 8260B
10/17/2001	MWA006	3709926	MWA006	10/23/2001	10/18/2001	75-01-4	Vinyl chloride	10	J		2 UGL	GROUNDWA	1	SW-846 8260B
10/17/2001	MWA006	3709926	MWA006	10/23/2001	10/18/2001	127-18-4	Tetrachloroethene	6	J		5 UGL	GROUNDWA	1	SW-846 8260B
10/17/2001	MWA006	3709926	MWA006	10/23/2001	10/18/2001	79-01-6	Trichloroethene	2700			5 UGL	GROUNDWA	1	SW-846 8260B
10/17/2001	MWA006	3709926	MWA006	10/23/2001	10/18/2001	71-55-6	1,1,1-Trichloroethane	580			5 UGL	GROUNDWA	1	SW-846 8260B